HITLER'S 'WONDER WEAPON' FIGHTER PROJECTS

LUFTWAFFE

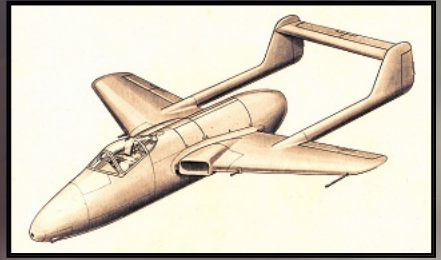
Secret Jets of the Third Reich

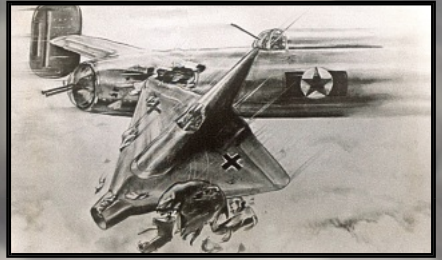
'DARTS OF DEATH' RAMMER REVEALED

BATWING ATTACKERS FROM HAMBURG

STATE OF THE ART NIGHT FIGHTERS

Dan Sharp



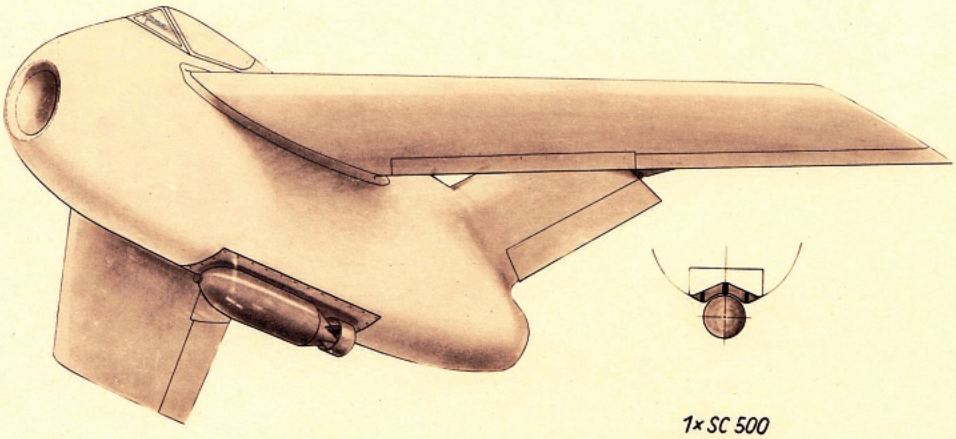


DOZENS OF PREVIOUSLY UNSEEN DRAWINGS AND PHOTOGRAPHS

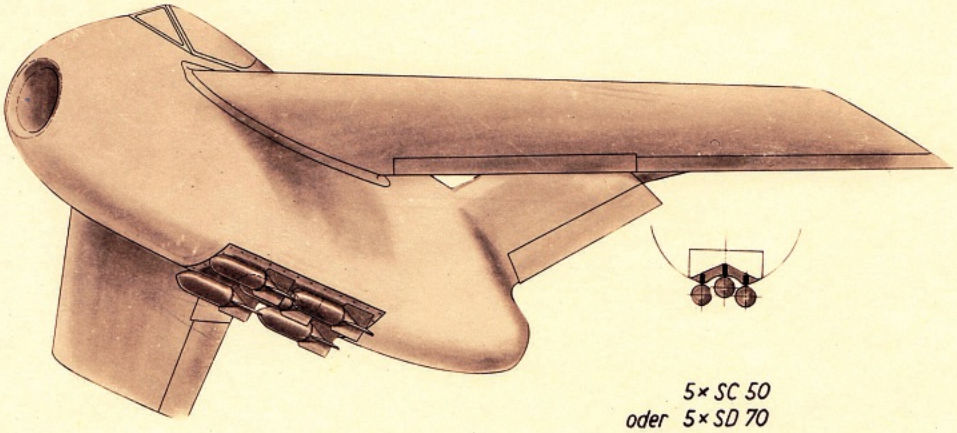
MORTONS MEDIA GROUP LTD

£6.99

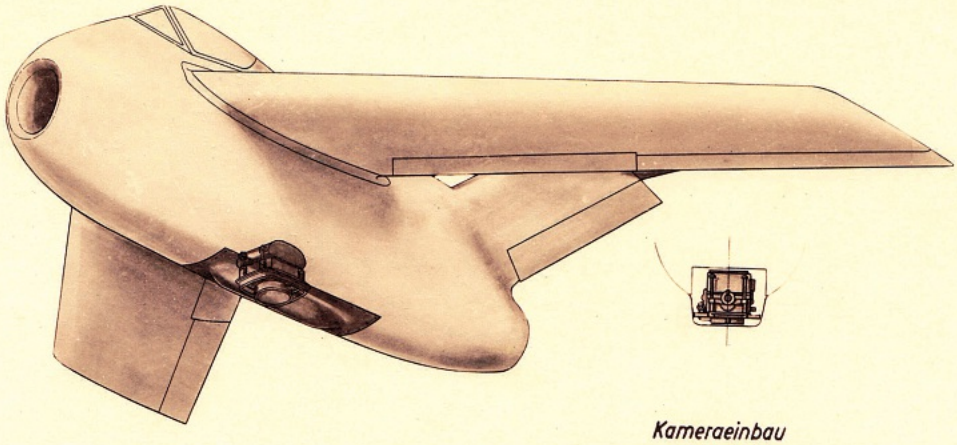
ISBN: 978-1-909128-70-5



1× SC 500
oder 1× SC 250
oder



5× SC 50
oder 5× SD 70



Kameraeinbau
Rb 20/30

Preface

The story of the aerial battles of the Second World War and the aircraft used during those battles has, for the most part, been very well known for a very long time.

Until the early 1990s however, few in the English speaking world, including myself, gave much thought to aircraft designed during the war that never saw service – either because they were flawed or simply because the circumstances did not allow it.

Having been brought up on tales of Spitfires and Hurricanes defending Britain from the Messerschmitt menace, it came as a surprise to me in 1991 when George Lucas's LucasFilm Games brought out a videogame called Secret Weapons of the Luftwaffe for the PC.

The image on the cover showed a pair of flying wing aircraft – they looked like something out of Star Wars – in German markings attacking a formation of high-flying American bombers.

I was intrigued. Did the Germans really have weapons like this? With no books being readily available on the subject I had to wait until the arrival of the Internet to find out.

In 1998 a friend of mine, with whom I had discussed the questions raised by Secret Weapons of the Luftwaffe, directed me to a website called Luft46.com and I was stunned to discover the vast and bewildering range of 'secret projects' apparently designed by German aircraft companies during the war.

There were flying wings, rammers, tiny bombers, parasite aircraft, types with a propeller at either end, twin-fuselage designs, tail-first designs, aircraft where the wings were swept forward, aircraft where the wings span around like the blades of a fan – a cornucopia of oddities.

Now books began to appear which elaborated a little on what the website's creator, Dan Johnson, had written. Many of these were translations from German titles and it soon became apparent that something had been lost during that process or else had not been there to begin with.

There were many inexplicable inconsistencies, projects that did not seem to fit in, projects with names that seemed wrong and nearly all without any real context. The projects' relationships with one another were confusing.

There had clearly been competitions run to find an aircraft design which best suited this or that set of requirements, and rival companies clearly supplied their own entries to these competitions, but what exactly these competitions were, when they were held, and which company entered what design to meet which requirements was a mystery.

Later books tended to lump designs together and state that they were part of something called the Jägernotprogramm or 'Emergency Fighter Programme'. But no one writer seemed able to quantify exactly what this programme set out to achieve, when it started or how it had progressed. Or to prove that it even existed at all.

This publication sets out to clearly show which designs were intended to do what, when they were created and how they fared against their competitors.

Rather than relying on the works of established authors for answers, I have attempted to base my work as far as possible on original German documents and contemporary Allied reports.

My starting point was a document which resides in the National Archives at Kew in London – German Aircraft: New and Projected Types. Compiled by British air intelligence staff in 1945 from captured German documents and published in January 1946, it includes drawings of 174 types from the full range of manufacturers and amounts to a factually reliable 'greatest hits' of secret projects.

The same document also includes the minutes of two meetings of the Entwicklungs-Hauptkommission (EHK) that took place towards the end of 1944. This was the main development committee for German aircraft and the minutes offer a dependable 'status update' on many of the otherwise obscure projects that were in progress at that time.

Onto this foundation dozens of other documentary sources, many of them apparently previously unseen, have been overlaid to build up a history of German jet or 'TL' (Turbinen-Luftstrahltriebwerk) aircraft development during the Second World War.

I have concentrated on jet fighter design and development primarily for reasons of space but also because fighters preoccupied the German aircraft manufacturers to a far greater extent than types designed for other roles.

It was generally accepted that a truly effective jet fighter, if one could only be designed and built, had the potential to alter the course of the war. Details of numerous jet fighter designs proposed by the German manufacturers have survived, though many undoubtedly have not. In addition, many were just ideas and were never submitted to the government for consideration.

Jet fighter designs submitted to meet government requirements, and those identified as having merit in EHK meetings, are examined here in the greatest detail.

Brochures, reports, construction proposals and a thousand other documents of the time are filled with charts, graphs and tables showing predicted performance data, dimensions, weights and innumerable other parameters. Where these have no bearing on the background or story of the design, they have been excluded.

Similarly, the German aircraft company chief designers, whose names appear frequently elsewhere, are seldom mentioned here. The likes of Kurt Tank, Willy Messerschmitt, Woldemar Voigt, Ernst Heinkel, Siegfried Günter, Walter Blume and Richard Vogt were high level executives and were seldom involved in the day-to-day business of designing their companies' aircraft in detail.

The actual designers remain a shadowy group whose names often appear on their work only as an illegible signature. When they wrote reports, their first name was often omitted or given only as an initial. Even today, little is known about the full complement of designers present at each company.

Finally, it must never be forgotten in whose name all of this work was carried out nor in what circumstances. The need to simplify designs so that the resulting aircraft could be manufactured in large part by unskilled slaves was ever present in the minds of these designers during the later stages of the war.

The vast sums of money required to bankroll all of this research and development work came from the coffers of the Nazi Third Reich. And the end product, the jet fighters that flew, were designed with the express purpose of destroying Allied aircraft and killing their crew. ●

006 **Introduction**

012 **Jagdflugzeuge mit Strahltriebwerk (1939)**
Heinkel He 280 *014*
Messerschmitt Me 262 *018*

024 **Arado Ar 234 (1940)**

028 **Messerschmitt Me 163 (1940)**

034 **Verschleissflugzeug (1944)**
Messerschmitt P.1104 *035*
Heinkel P.1077 'Julia' *035*
Junkers EF.127 'Walli' *035*
Messerschmitt Me 263 (Junkers Ju 248) *036*
Messerschmitt Me 262 with supplementary rocket propulsion *037*
Bachem BP 20 (Ba 349) Natter *039*

044 **Schlechtwetter und Nachtjäger (1944)**
Messerschmitt Me 262B-1a/U1 *044*
Arado Ar 234B-2/N *045*
Dornier Do 335A-6 and P.254 *045*
Messerschmitt three-seater night fighter *046*
Arado Ar 234P-5 *046*

048 **1-TL-Jäger (1944)**
Blohm & Voss P.212 *050*
Focke-Wulf I and II *054*
Heinkel P.1078 *064*
Junkers EF.128 *066*
Messerschmitt P.1101 *068*
Messerschmitt P.1106 *068*
Messerschmitt P.1110 *072*
Messerschmitt P.1111 *072*
Messerschmitt P.1112 *073*

074 **Volksjäger (1944)**
Arado E.580 *074*
Blohm & Voss P.211 *075*
Focke-Wulf Volksflugzeug and Einheits-T-L Jäger *075*

Contents

ABOVE: A Messerschmitt P.1070 shoots down a luckless De Havilland Mosquito. The tiny P.1070 was considered as a lightweight alternative to the Me 262. **Art by Ronnie Olsthoorn**

FRONT COVER:
Focke-Wulf Triebflügeljäger in combat with Northrop B-35s of the 94th BG over Germany by Ronnie Olsthoorn. For more information about Focke-Wulf ramjet projects see page 98.

AUTHOR: Dan Sharp
DESIGN: atg-media.com
REPROGRAPHICS: Jonathan Schofield and Paul Fincham
PUBLISHER: Dan Savage
MARKETING MANAGER: Charlotte Park
COMMERCIAL DIRECTOR: Nigel Hole

PUBLISHED BY: Mortons Media Group Ltd, Media Centre, Morton Way, Horncastle, Lincolnshire LN9 6JR.
Tel. 01507 529529

THANKS TO: Hamza Fouatih, Simon Fowler, Paul Martell-Mead, Ronnie Olsthoorn, Alexander Power, Chris Sandham-Bailey, Stephen Walton and Tony Wilson

PRINTED BY: William Gibbons and Sons, Wolverhampton

ISBN: 978-1-909128-70-5

MORTONS MEDIA GROUP LTD

Junkers Volksjäger Projekt *076*
Heinkel P.1073 (He 162) *076*

080 **Schlechtwetter und Nachtjäger (1945)**
Arado I and II *082*
Blohm & Voss P.215 *084*
Focke-Wulf II and III *088*
Dornier P.256 *089*
Gothaer P-60C *090*

092 **Pulse jet projects (1944-1945)**
Messerschmitt Me 328 *092*
Blohm & Voss P.213 *093*
Junkers EF.126 'Elli' *094*
Heinkel 'Romeo' *094*
Heinkel He 162 with Argus tube *094*

096 **Skoda-Kauba P.14 and Me 262** with ramjets

098 Focke-Wulf Triebflügeljäger
Focke-Wulf Strahlrohrjäger *099*

102 **Heinkel P.1080**

104 **Horten 8-229**

108 **Lippisch P.11 / Delta VI**

112 **Lippisch P.12/13 and P.15**

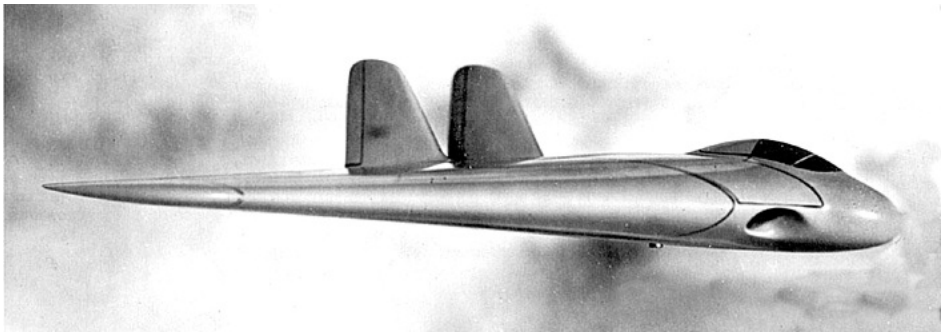
120 **Arado E.381 Kleinstjäger**

124 **Unknown!**
Messerschmitt Schwalbe *125*
Messerschmitt Wespe *125*
Messerschmitt Libelle *125*
Messerschmitt Wildgans *125*
Blohm & Voss Ae 607 and MGRP *126*
Focke-Wulf Super TL and Super Lorin *126*
Heinkel Lerche I-III and Wespe *126*
Henschel projects *128*
BMW single jet projects *130*

Development ove

Germany's Second World War jets – an introduction

As Spitfires and Bf 109s clashed over France during the spring of 1940, efforts to develop jet and rocket-propelled fighters for the Luftwaffe were already well advanced. By 1944 they were entering service and plans were being laid for the next generation…



ABOVE: A wind tunnel model of the Lippisch Delta VI that was painted up, photographed and set against a 'sky scene' for promotional purposes during early 1944. The Delta VI was typical of advanced projects being dreamt up by Germany's aircraft designers during the final year of the Second World War. TNA

Development of the jet engine in Germany began and progressed in parallel with work on gas turbines taking place in Britain during the mid-1930s. By the end of the decade, however, the Germans had moved much more decisively to realise the new powerplant's potential.

The German government encouraged all of the country's major engine manufacturers to begin work on jet engine designs and as a result, despite the technological challenges involved, BMW, Junkers and Heinkel made significant progress during the early part of the Second World War.

At the same time, pioneering work on rocket engines and gliders carried out during the late 1920s and throughout the 1930s was also coming to fruition.

By 1944, just as the war was reaching its tipping point, a whole host of interrelated aviation development programmes began to pay off.

The extensive and tortuous development of the Messerschmitt Me 262 jet fighter had come to an end, as had the bringing together of aerodynamicist Alexander Lippisch's 'bat wing' gliders with rocket pioneer Hellmuth Walter's powerful engines, resulting in the Me 163.

Both machines were at the cutting edge of what was possible with 1940s technology – but neither was capable of meeting the Luftwaffe's operational requirements as the nature of the aerial threat facing Germany continued to evolve.

The Me 262 arrived too late to operate as a fighter-bomber over the Normandy beaches as Adolf Hitler had himself envisioned, and the Me 163 arrived too late and was too flawed to be an effective bomber interceptor – the role to which it eventually seemed most suited, though it had not been designed as such at the outset.

The third successfully realised design, Arado's Ar 234, was highly capable as a reconnaissance aircraft but again arrived too late to have any impact. In its other role as a bomber it carried only a small payload – useless for inflicting the mass on-the-ground destruction needed at this stage of the war.

GERMAN JET AIRCRAFT DEVELOPMENT

• **November 9, 1935**	Hans Joachim Pabst von Ohain is granted a patent for his latest invention – Germany's first turbojet design.
• **Early 1936**	Dr Herbert Wagner begins developing gas turbine engines for Junkers.
• **April 15, 1936**	Hans von Ohain is hired by Dr Ernst Heinkel to create a working example of his jet engine.
• **Circa February 28, 1937**	Von Ohain's first working jet engine, the HeS 1 is completed and installed in a test rig.
• **Early 1938**	Design work begins at Heinkel on an aircraft that can be powered by Von Ohain's new engine. At Junkers, Wagner begins construction of his own experimental turbojet engine.
• **Autumn 1938**	German aero engine manufacturers Daimler-Benz, BMW, Brandenburgische Motorenwerke (Bramo) and Junkers are encouraged to look at turbojet development by the Reichsluftfahrtministerium (RLM).
• **December 1938**	Messerschmitt receives a contract to carry out feasibility studies for the design of a single-seat fighter with turbojet propulsion.
• **Early 1939**	Junkers' Rückstoss-Turbinen-Strahltriebwerk (RTO) or 'Reaction Turbojet Engine' runs up to 6500rpm on a test stand. It is designed to reach 12,900rpm.
• **January 2, 1939**	Glider designer Alexander Lippisch is transferred from the Deutsche Forschungsanstalt für Segelflug (DFS) to Messerschmitt, after completing the ultimate civilian development of his work on tailless aircraft, Entwurf X or 'Design 10', his previous project for the DFS having been the Storch IX or 'Stork 9'. This was later officially designated the DFS 194 by the RLM. He immediately begins work on modifying the DFS 194 design, originally intended to be driven by a propeller at the rear, to accommodate a Walter R I-203 rocket engine.
• **January 4, 1939**	Heinkel and Messerschmitt each receive a contract to begin work on the design of single-seat fighter aircraft with turbojet propulsion – 'Jagdflugzeuge mit Strahltriebwerk'.
• **April 1, 1939**	Following preliminary studies, Messerschmitt's design team set to work in earnest on their first draft of a single-seat jet fighter, project P.65 – later referred to as P.1065.
• **Circa June 1939**	Heinkel begins work on two mock-ups of its projected twin-engine turbojet fighter.
• **June 7, 1939**	The Messerschmitt P.1065 design, intended to be powered by two wing-mounted BMW jet engines, is submitted to the RLM. The RLM asks Messerschmitt to produce a mock-up of the design.
• **July 1939**	Bramo is amalgamated into BMW. The jet engine it has been working on is renamed P.3302. BMW's own design, the P.3304, is ultimately abandoned.
• **August 27, 1939**	An aircraft powered by Von Ohain's latest jet engine design, the HeS 3b, takes flight. The Heinkel He 178 V1 is the first jet-powered aircraft to fly anywhere in the world.

rdrive

So by early 1944 the Luftwaffe had, or nearly had, three viable jet and rocket aircraft that were largely incapable of doing what was needed – intercepting the RAF's high-flying de Havilland Mosquito reconnaissance aircraft, inflicting severe damage on the Eighth Air Force's daytime bomber fleet, locating and destroying the RAF's night bombers, and after the D-Day invasion, combating Allied fighter-bombers at low altitude.

The Me 262 could just about manage day bomber interceptions but the night bombers and fighter-bombers had to be left to piston-engine machines. And nothing could touch those Mosquitos.

New aircraft were urgently required that could successfully carry out at least one of these missions, if not all four.

ABOVE: With the introduction of the de Havilland Mosquito, the Allies had a means of overflying Germany with near-impunity to take reconnaissance photos. Developing an interceptor that could catch the powerful and high-flying British aircraft was a high priority in 1944. via author

There was a fifth requirement too. The Me 262 needed two jet engines – resulting in twice the cost and twice the trouble to both produce and fly it. It also made use of expensive materials that were in short supply, as did the Me 163. New aircraft designed to meet the other four requirements would need to be made as cheaply as possible and from 'non-strategic' materials too, this last being mostly a euphemism for wood and glue.

Fortunately, Germany had already spent more than a decade developing the greatest concentration of aviation research and development facilities the world had ever seen. There were no fewer than 63 wind tunnel facilities in operation – 14 at universities, 39 at aeronautical research centres and 10 belonging to individual firms. There were even another 15 in occupied countries to which the German firms had access. Nineteen of the overall 78 wind tunnels were suitable for use in high-speed flight research.

Across the industry, the number of personnel involved in development work increased from 7000 in 1943 to 8000 by 1945. In addition, the budget for aviation research and development soared from 340 million Reichsmarks in 1943 to 500 million RM in 1945.

At the same time, a new organisation formed in March 1944, the Jägerstab or 'Fighter Staff', was in the process of ruthlessly reducing the number of different aircraft types being produced by Germany's factories – freeing up production capacity and focusing efforts on the materials and tooling required for manufacturing fighters, rather than bombers.

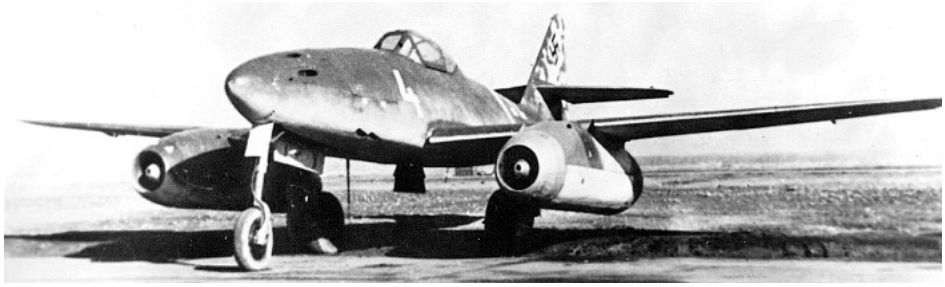
Given this tremendous accumulation of resources, there was every reason to believe that the new fighters so desperately needed by the Luftwaffe could be produced in record time. ▶

ABOVE: Much of German aircraft manufacturers' design and development effort from late 1943 onwards was devoted to finding a way of combatting the increasingly effective USAAF daylight raids over Germany. NARA

TIMELINE

• **September 1, 1939**	The Second World War begins.
• **September 26, 1939**	RLM representatives inspect the two completed mock-ups of Heinkel's jet fighter design. The aircraft receives an official RLM designation – He 280.
• **October 16, 1939**	Work on fitting Lippisch's DFS 194 with a Walter rocket motor is completed and ground tests begin. It is found that making the engine an integral part of the airframe is a fundamentally bad idea – making it difficult and dangerous to service and repair.
• **November 1, 1939**	The Heinkel He 178 is demonstrated in front of RLM representatives.
• **December 1939**	Junkers begins work on a development of Wagner's design, the Jumo T1 jet engine design, later known as the Jumo 004.
• **December 19, 1939**	Messerschmitt's P.1065 mock-up is examined by the RLM.
• **Circa 1940**	Messerschmitt's designers begin work on a parallel project to the P.1065 – the smaller P.1070 – which has a tricycle undercarriage and its engines mounted in its wings.
• **Circa spring 1940**	The RLM asks Arado to design a bomber/photo reconnaissance aircraft that can be powered by either Junkers or BMW jet engines.
• **March 1940**	It is proposed that 20 prototypes of the P.1065 should be built, to be powered by the BMW P.3302.
• **August 1940**	Alexander Lippisch's DFS 194 flies under rocket power for the first time.
• **September 22, 1940**	Glide tests are begun on the first completed airframe of Heinkel's He 280 design.
• **December 1940**	The prototype BMW P.3302 V1 jet engine is run for the first time.
• **Winter 1940**	Work on the first prototype of the rocket-powered Messerschmitt Me 163, a development of Lippisch's DFS 194, is completed.
• **February 1941**	Construction of the first prototype Messerschmitt P.1065 begins.
• **March 30, 1941**	The Heinkel He 280 V2 flies under its own power for the first time.
• **April 8, 1941**	Messerschmitt's P.1065 is given an official RLM designation – Me 262.
• **April 18, 1941**	The Me 262 V1, PC+UA, makes its first flight, albeit powered by a Jumo 210G piston engine.
• **Spring 1941**	Unpowered flight testing of the Me 163A V1 prototype begins.
• **July 14, 1941**	Following the invasion of the Soviet Union, Hitler issues Führer Directive No. 32 (Supplement), restricting the allocation of non-war-essential military equipment development contracts. Work on new jet fighter types for the Luftwaffe comes to a halt. It is anticipated that victory in the East will be swift.

ABOVE: After D-Day, the Luftwaffe had yet another problem – how to combat powerful and heavily armed Allied fighter-bombers such as the RAF's Hawker Typhoon at low level. via author



ABOVE: The Messerschmitt Me 262 had an incredible turn of speed and awesome firepower but it was expensive, took too long to build and was little use in low-level combat. The Germans also feared that its development potential was limited and that it would soon be overmatched by new Allied jet types. via author

However, there were still serious doubts about whether jet engines were actually the best way forward. Was there still life in the Otto engine yet? Otto being the contemporary German way of referring to the piston engine, after pioneering German inventor Nikolaus Otto.

Three days after being appointed chairman of the Entwicklungs Hauptkommission Flugzeuge, a new committee intended to centralise and direct development of aircraft, Luftwaffe chief engineer Roluf Lucht stated: "On the basis of the aforementioned advantages and disadvantages, the single-engined pusher-propeller Otto fighter, which can perform the role of the Do 335 at approximately half the cost, is very economical for use against bombers at all heights.

"It is equally suitable for deployment against enemy Otto fighters at all altitudes. Thanks to its endurance the Otto fighter is the type most suited to protecting any given area of airspace. And due to its economical cruise capability, the Otto fighter performs better at all heights in bad weather and blind-flying conditions than would a jet-powered aircraft.

"Furthermore, it is the most suitable fighter for operation in greater numbers when circumstances call for massed formations. In our opinion, and in the light of the above, the Otto fighter at its most advanced stage of development with pusher propeller is indispensable for aerial defence duties above and behind the front lines.

"And thanks to its being less susceptible to ground fire, it also lends itself to use in the fighter-bomber and ground-attack roles."

The aircraft companies themselves, however, were convinced that there was little left to gain from continued development of piston engine aircraft, pusher or otherwise.

Arado director Walter Blume wrote on November 2, 1944: "To increase the speed of Otto-engined aircraft requires more time and expense in every way. This is because, with Otto engines, it is a matter of fighting for a percentage increase in the output and performance of every one of their component parts, with very little end result to show for all the work involved."

At a meeting of Lucht's committee on December 19-20, Willy Messerschmitt declared that his company would no longer be involved in any piston-engine fighter projects, with the exception of supporting the Bf 109 until its imminent replacement on production lines.

As far as jet design was concerned, the first competition was a two-horse race between the Me 262 and the He 280 beginning in January 1939. Both were entirely dependent on the development of sufficiently reliable and powerful engines – which only became available, in the form of the Jumo 004, in July 1942.

At the same time, great effort was being

GERMAN JET AIRCRAFT DEVELOPMENT TIMELINE

• **August 13, 1941**	First rocket-powered flight of Me 163A V1.
• **October 24, 1941**	Arado has finally come up with a concrete proposal for the RLM's bomber/reconnaissance jet requirement – the E.370/IVa. It is examined by the RLM and an initial batch of 50 aircraft are ordered.
• **November 1941**	Two BMW P.3302 prototype engines are delivered to Messerschmitt for installation in the Messerschmitt Me 262 V1 prototype.
• **December 1941**	Design work starts on a production version of the Me 163A, which is deemed too complicated for series production. This will be designated the Me 163B.
• **February 1942**	Arado's E.370 design is allocated the official RLM designation Ar 234.
• **March 25, 1942**	A first jet-powered flight of the Me 262 V1 is attempted but ends in failure after both its BMW engines fail.
• **April 1942**	The RLM orders six Ar 234 prototypes. Work on the first prototype Me 163B is completed.
• **May 26, 1942**	First glider flight of the Me 163B V1.
• **May 29, 1942**	The RLM reduces its Me 262 prototype order to just five examples.
• **July 5, 1942**	Flight testing of the He 280 V3, using two of Von Ohain's HeS 8A jet engines, begins.
• **July 18, 1942**	Me 262 V3 flies for the first time with Jumo 004 engines. It completes 25 minutes of trouble-free flying.
• **September 1942**	Although Me 262 V3 has been wrecked in an accident, its reliable performance convinces the RLM to reinstate the type's formerly cancelled additional prototypes.
• **November 5, 1942**	Focke-Wulf produces drawings for a jet-engined Fw 190, using a powerplant of its own design.
• **November 18, 1942**	The RLM reduces its He 280 prototype order to just six examples plus one unpowered aircraft for high speed testing.
• **December 10, 1942**	With the tide of battle in the East turning against Germany, and with no imminent victory in sight, Erhard Milch orders into effect "an urgent development and production programme under the code word Vulkan. The programme encompasses jet-propelled aircraft and guided missiles, including associated equipment and the ground organisation necessary to support these activities". The aircraft given top priority for procurement of equipment are the Me 163, Me 262, He 280, Me 328 and Ar 234.
• **December 28, 1942**	The RLM increases its order for Ar 234 prototypes from six to 20.
• **January 4, 1943**	Focke-Wulf designer Julius Rotta sets out how the company will approach future jet design and suggests an aircraft layout similar to what will eventually be produced as the Heinkel He 162.

expended on developing Germany's piston-engine fighters such as the Fw 190 and its intended replacement, the Ta 152, and the Bf 109 and its various potential successors, such as the Me 209, Me 309 and Me 155.

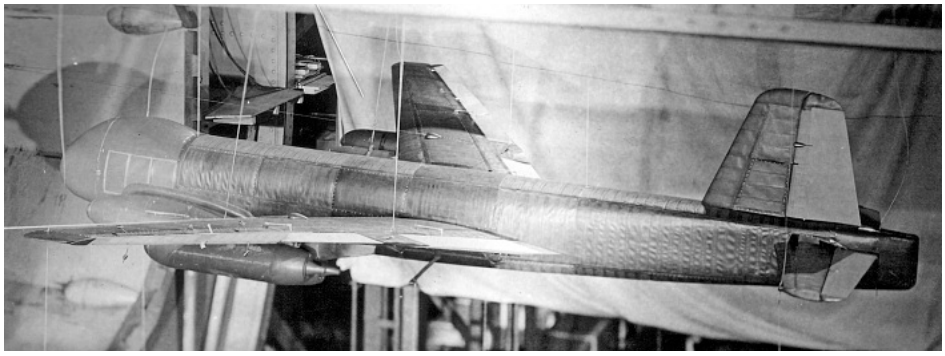
The next jet competition was not until early 1944 when the requirement for a cheap short range interceptor was issued – the Verschleissflugzeug. Next came a contest for an interim jet bad weather and night fighter, then the 1-TL-Jäger (single jet fighter) competition.

These were all begun in a timely fashion, with tenders being requested and designs submitted. Then all three were leapfrogged by the Volksjäger requirement – for which speed of design and production was everything. Finally, there came a requirement for a definitive state-of-the-art bad weather and night fighter in January 1945.

In addition to these five competitions, the major companies came up with numerous private ventures – entrepreneurial bright ideas which, it was hoped, would attract a development contract to at least explore the technology involved.

There were also smaller companies and individuals that participated on unique terms. Particularly noteworthy among these were the Horten brothers, Me 163 designer Alexander Lippisch and Eric Bachem's Bachem Werke. The designs of these 'outsiders' were given serious consideration at the highest levels alongside those of the large firms.

It has been stated time and again that the German aircraft designers were deluded – that ▶



ABOVE: Wind tunnel test model of the Junkers Ju 287 fast bomber. The proliferation of wind tunnels in Germany enabled a huge number of different designs to be tested quickly and rapidly advanced designers' knowledge of aerodynamics. Conversely, it has been argued that the opportunity to test so many designs resulted in too much data – making it difficult and time-consuming to decide which forms and features worked best. via author

ABOVE: During 1944 the German aircraft manufacturers were torn between expediting the production of high-performance piston-engine or 'Otto' types, such as the Focke-Wulf Ta 152, and throwing all their resources behind turbojet designs. via author

FROM FIRST DESIGNS TO FULL SERVICE

MESSERSCHMITT ME 262

First designs:	June 7, 1939
First prototype completed:	November 1941
First successful powered flight:	October 1, 1942
Into service:	June 1944
Total time taken:	Around five years.

MESSERSCHMITT ME 163

First designs:	January 2, 1939 (modifying DFS 194)
First prototype completed:	Winter 1940 (Me 163A)
First successful powered flight:	August 13, 1941
Into service:	January 1944
Total time taken:	Around five years.

ARADO AR 234

First designs:	October 24, 1941
First prototype completed:	Early summer 1943
First successful powered flight:	July 30, 1943
Into service:	June 1944
Total time taken:	Two years, eight months.

HEINKEL HE 162

First designs:	September 10, 1944 (July 1944 as P.1073)
First prototype completed:	December 1, 1944
First successful powered flight:	December 6, 1944
Into service:	February 27, 1945
Total time taken:	Five to seven months.

• **January 22, 1943**	At an RLM conference, Willy Messerschmitt proposes a jet-propelled version of the Bf 109, the Bf 109TL – which would bring together the fuselage of the Me 155 high-altitude fighter and the wing and undercarriage of the Me 309, both projected successors to the Bf 109 itself.
• **March 9, 1943**	The RLM decides against series production of the Heinkel He 280 – primarily due to the minimal ground clearance of its low slung engine pods. This is officially confirmed in a letter to Heinkel dated March 27, 1943.
• **May 22, 1943**	General of Fighters Adolf Galland flies the Me 262 at Lechfeld.
• **May 25, 1943**	Galland convinces Hermann Göring to have Messerschmitt drop its latest proposed Bf 109 replacement, the Me 209, in favour of all-out production of the Me 262.
• **June 22, 1943**	Messerschmitt's plan for series production of the Me 262 is approved.
• **Early summer 1943**	The first Ar 234 prototype is completed and taxiing trials begin.
• **June 24, 1943**	First rocket-powered flight of the Me 163B V1 prototype.
• **July 30, 1943**	The Ar 234 V1 is successfully flown for the first time.
• **August 17, 1943**	Me 262 production is delayed when a US bombing raid destroys fuselage construction jigs at Messerschmitt's Regensburg plant, prompting the firm to move key departments to Oberammergau in the Bavarian Alps.
• **January 1944**	The first production batches of Me 163B-0 and B-1 airframes are completed but no engines are available.
• **March 1, 1944**	The Jägerstab (Fighter Staff), a committee of industrialists and RLM officials is established with the goal of reinvigorating Germany's flagging aviation industry. This effectively ends the RLM's direct involvement in aircraft production, allowing it to focus on research and development.
• **Spring 1944**	A requirement is issued by the RLM for a simple, quick and cheap to mass produce interceptor that is easy to fly and can be launched in large numbers to protect key targets from bombing raids, under the designation 'Verschleissjäger' or 'Attrition Fighter', as in swarms of these machines 'wearing down' the enemy's bombers.
• **June 1944**	The first 20 pre-production Arado Ar 234B-0 aircraft are delivered.
• **Early July 1944**	The Jägerstab issues a requirement for a new fighter aircraft, a '1-TL-Jäger'. It must be powered by a single jet engine and four firms, Blohm & Voss, Focke-Wulf, Heinkel and Messerschmitt, are invited to submit tenders. The design must be ready to present within eight weeks – by early September – with a mock-up ready a month later, a prototype ready to fly by December 1, 1944, and series production commencing on January 1, 1945.

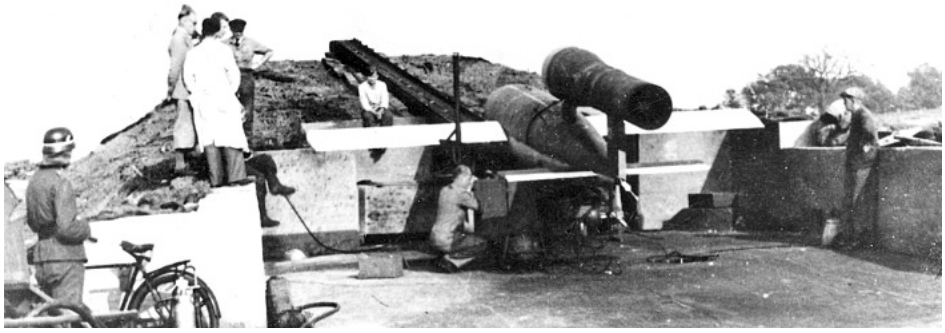
ABOVE: The Blohm & Voss BV 155, an extreme development of the Me 155, which was itself a development of the Bf 109, was entering the prototype testing phase as the war came to an end. Had it reached full production, it might have been able to combat the constant Mosquito incursions over German territory. via author

ABOVE:The enormous wingspan of the BV 155 is evident from this image. The large pods under the wings are actually radiators for its engine. By 1945, the German aircraft manufacturers had all but given up on piston engine types for future production – making the BV 155 practically obsolete before it had even been completed. via author

the war was clearly lost by 1944 and that working on a great diversity of designs was a waste of valuable time and resources. There should have been a concerted effort to produce the Me 262 in greater numbers, it is argued. Indeed, this particular point was advocated by many ex-Luftwaffe pilots after the war.

Alternatively, some have speculated that the German designers, realising that the war was lost, created designs they knew could never be realised by their own nation in the hope of buying themselves a degree of favour with the victorious Allies.

Both of these views are strongly coloured by hindsight. Even at the beginning of 1945, the Allies had yet to penetrate the borders of Germany itself – the final collapse, when it did



ABOVE: It has been suggested that the German aircraft designers had a fair idea that the war was lost by the beginning of 1945 but this appears to have been untrue. Few had any real tactical awareness of the unfolding situation on the ground – as the Allies approached – and many held hopes that technological advances, such as the Fieseler Fi 103 V-1 flying bomb would yet succeed in slowing or stopping the Allied advance. via author

ABOVE: Among the high-performance piston-engine types entering the final stages of development during the last days of the Second World War was the Dornier Do 335. Had its development programme not been beset by technical difficulties, and had Dornier's facilities not suffered severe damage during bombing raids, the twin-engine type might have entered service during 1944. via author

GERMAN JET AIRCRAFT DEVELOPMENT TIMELINE

• **September 8-10, 1944**	A meeting is held at the Messerschmitt facility in Oberammergau where the four firms invited to tender for the '1-TL-Jäger' requirement of July are supposed to present their initial designs for assessment. The Blohm & Voss submission is deferred since it is not yet ready. Focke-Wulf's design is largely rejected and Junkers is invited to submit designs for the requirement, bringing the number of firms now involved to five.
• **September 10, 1944**	Just as the '1-TL-Jäger' meeting draws to a close, the RLM invites Arado, Blohm & Voss, Fieseler, Focke-Wulf, Heinkel, Junkers, Messerschmitt and Siebel to tender submissions for a new requirement designated 'Volksjäger' or 'People's Fighter'. This calls for a lightweight fighter built from existing components and powered by a single BMW 003 jet engine.
• **September 14-15, 1944**	A meeting is held at the RLM's offices in Berlin and five of the firms invited to tender for the 'Volksjäger' requirement present their designs – Arado, Blohm & Voss, Focke-Wulf, Heinkel and Junkers. Messerschmitt refuses to offer any designs while Fieseler and Siebel are unable to come up with anything suitable in the four days allowed. The Arado, Focke-Wulf and Junkers designs are quickly rejected.
• **September 15, 1944**	A new main development committee, the Entwicklungs Hauptkommission (EHK), led by Luftwaffe chief engineer Roluf Lucht, is established by Germany's minister for war production, Albert Speer, to oversee work on new aircraft types. Among its members are Focke-Wulf chief designer Kurt Tank, Willy Messerschmitt, Walter Blume of Arado and Heinrich Hertel from Junkers.
• **September 17, 1944**	Another meeting is held to discuss the two 'Volksjäger' finalists – Heinkel's P.1073 and Blohm & Voss's P.211. No decision is reached.
• **September 19, 1944**	Yet another meeting is held to discuss the 'Volksjäger' finalists is held and all the original entries are reviewed – along with new entries from Fieseler, Focke-Wulf, Junkers and Siebel.
• **September 23, 1944**	Hitler orders Heinkel's P.1073 design into mass production.
• **October 3, 1944**	Heinkel's P.1073 is given the official RLM designation He 162.
• **October 25, 1944**	Work begins on the first He 162 prototypes.
• **November 28-29, 1944**	Submitted designs for the 'Verschleissjäger' requirement are reviewed. None of the four finalists are rejected but they are ranked in the following order: Messerschmitt's rocket-enhanced Me 262, Heinkel's 'Julia', the Junkers/Messerschmitt 8-263 and Bachem's Natter.
• **December 1, 1944**	The He 162 M1 (V1) is finished and ready to fly.
• **December 6, 1944**	He 162 M1 flies for the first time.
• **Early December, 1944**	Junkers submits a new design for the 'Verschleissjäger' requirement, the EF.127 'Walli'.
• **December 10, 1944**	The He 162 M1 is destroyed during testing, killing its pilot.
• **December 15, 1944**	Discussions take place at the RLM in Berlin regarding the five companies' submissions to the '1-TL-Jäger' requirement. The companies present their updated designs – Junkers presents its EF.128 for the first time – but no agreement can be reached on the system of calculation that will be used to compare their projected performances.

come, came swiftly. The overall state of the Reich's ground defences was largely unknown to the aircraft firms in 1944.

In addition, it was impossible to tell what effect the V-1 and V-2 missiles were having. Could these non-Luftwaffe aerial terror weapons serve to halt the Allies? Or even persuade them to sue for peace?

The Germans also believed the Western Allies would, sooner rather than later, realise that the Soviet Union was the real threat and join forces with them to oppose the Red Tide sweeping in from the East. If some sort of deal to oppose Stalin was worked out, the Luftwaffe would need new aircraft to oppose the communists.

As for the designers' work, throughout 1943 and 1944 it was considered entirely possible that a breakthrough in engine design and production might finally deliver the powerplants necessary for reliable high performance jet aircraft. It always seemed as though such a breakthrough was imminent, and the fact that it wasn't could not have been guessed at the time.

In addition, although multiple advanced designs were worked on, very few actually reached the stage where any significant amount of manpower would be required to make them a fully functioning reality. Surviving documents suggest that a lot more time was spent working through complicated equations relating to aerodynamics and performance, and conducting tests on new construction processes, than was spent actually putting pen to paper and drawing pictures of potential aeroplanes.

The German aircraft companies functioned much as their counterparts in other countries did during wartime: they attempted to meet the urgent needs of their nation's military aviators as quickly and as effectively as possible. In the process, they created the fascinating designs chronicled in this publication. ●

RLM JET REQUIREMENTS WITH COMPETING DESIGNS

JAGDFLUGZEUGE MIT STRAHLTRIEBWERK (Jet fighter)
Date: January 1939
Competitors:
- Messerschmitt P.1065 (Me 262)
- Heinkel He 280

VERSCHLEISSJÄGER (Attrition fighter)
Date: Circa spring 1944
Competitors:
- Bachem BP 20 Natter
- Heinkel 'Julia'
- Junkers EF.127 'Walli'
- Messerschmitt P.1104
- Me 262 with rocket boost
- Me 263

SCHLECHTWETTER UND NACHTJÄGER (Bad weather and night fighter)
Date: Circa summer 1944
Competitors:
- Ar 234B-2/N then Ar 234P-5
- Do 335A-6 then Dornier P.254
- Me 262B-1a/U1 then Messerschmitt three-seat night fighter

1-TL-JÄGER (Single jet fighter)
Date: July 1944
Competitors:
(round 1 – July to September 1944)
- Blohm & Voss P.209 (submitted late)
- Focke-Wulf 1-TL- Jäger (Nr. 280 aircraft)
- Heinkel P.1073
- Messerschmitt P.1101

(round 2 – September to December 1944)
- Blohm & Voss P.212
- Focke-Wulf 1-TL- Jäger (Nr. 279 aircraft)
- Heinkel P.1078A
- Junkers EF.128

(Messerschmitt P.1101 until some time in November)
- Messerschmitt P.1106
- Messerschmitt P.1110

(round 3 – December 1944 to February 1945)
- Blohm & Voss P.212
- Focke-Wulf I (Nr. 279 aircraft)
- Focke-Wulf II (Kurzbaubeschreibung Nr. 30 aircraft)
- Heinkel P.1078C
- Junkers EF.128
- Messerschmitt P.1101 (reinstated)
- Messerschmitt P.1110
- Messerschmitt P.1111

VOLKSJÄGER (People's fighter)
Date: September 1944
Competitors:
- Arado E.580
- Blohm & Voss P.211
- Focke-Wulf Volksflugzeug
- Focke-Wulf Einheits TL Jäger
- Heinkel P.1073 (simplified version)
- Junkers EF.123 or EF.124

SCHLECHTWETTER UND NACHTJÄGER (Bad weather and night fighter)
Date: January 1945
Competitors:
- Arado I (E.583)
- Arado II (E.583)
- Blohm & Voss P.215
- Dornier P.256
- Focke-Wulf II
- Focke-Wulf III
- Gothaer P-60C

• **December 19-20, 1944**	During a meeting of the main design and development commission Willy Messerschmitt states that his company will henceforth no longer be involved in the development of Otto engine fighter except developments of the Bf 109.
• **December 22, 1944**	The He 162 M2 is flown for the first time. At a meeting, the 'Verschleissjäger' designs are reviewed again and the Messerschmitt/ Junkers 8-263 is chosen for further development. Development of the rocket-enhanced Me 262 is to continue, work on Junkers' EF.127 'Walli' is to be suspended and both Bachem's Natter and Heinkel's 'Julia' are to be cancelled.
• **January 12-15, 1945**	Further discussions take place at the RLM in Berlin regarding the five companies' submissions to the '1-TL-Jäger' requirement. A mathematical formula for comparing the submitted designs has now been agreed but none of the submitted designs now comes close to meeting the amended requirements.
• **January 27, 1945**	Technical specifications are issued for the new 'Schlechtwetter– Tag– und Nachtjäger' or 'Bad Weather Day- and Night-fighter' requirement.
• **February 9, 1945**	The first five production He 162s are completed.
• **February 22, 1945**	Hermann Göring rules that no further piston engined fighters are to be developed.
• **February 26, 1945**	Further discussions take place regarding the Arado, Blohm & Voss, Dornier, Focke-Wulf and Gothaer submissions to the 'Schlechtwetter– Tag– und Nachtjäger' requirement.
• **February 27, 1945**	Technical specifications for the 'Schlechtwetter– Tag– und Nachtjäger' requirement are altered, making the designs submitted so far inadequate. On the same day, the Luftwaffe pilots fly a He 162 for the first time – He 162 M19.
• **February 27-28, 1945**	Further discussions take place at the RLM in Berlin regarding the five companies' submissions to the '1-TL-Jäger' requirement. No decision is reached.
• **March 20-21, 1945**	A final discussion takes place at Focke-Wulf's Bad Eilsen facility regarding the submissions to the 'Schlechtwetter– Tag– und Nachtjäger' requirement. The designs submitted by Dornier and Focke-Wulf are apparently rejected.
• **March 22-23, 1945**	A final discussion takes place at Focke-Wulf's Bad Eilsen facility regarding the five companies' submissions to the '1-TL-Jäger' requirement. Junkers apparently receives a development contract for its EF.128 design.
• **March 31, 1945**	Heinkel's technical design department is evacuated from Vienna, ending work on all projects. On the same day, deliveries of production He 162s to JG 1 finally begin.
• **April 8, 1945**	British forces overrun Focke-Wulf's Bad Eilsen design facilities, ending work on all projects.
• **April 29, 1945**	American forces overrun Messerschmitt's Oberammergau design facilities, ending work on all projects.
• **May 1, 1945**	JG1 ferry pilots try and fail to free the last two He 162s from their construction jigs at Rostock before the Heinkel facility is overrun by Soviet troops.
• **May 3, 1945**	British forces overrun Blohm & Voss's headquarters in Hamburg. It is likely that work on all projects ended some time in mid-April.

The first contest

Jagdflugzeuge mit Strahltriebwerk (January 1939)

Bench tests and impressive theoretical performance figures convinced the RLM that it was time to begin the development of Germany's first jet-propelled fighter in 1938. But which firm would design and build it?

Hans Joachim Pabst von Ohain began theoretical work on gas turbine propulsion in 1933 aged 22, unaware that similar research had been started by Frank Whittle in Britain three years earlier.

The following year, Dr Herbert Wagner of Junkers undertook some private research into the possibility of a turboprop engine and thereby began work on his own independent turbojet design. The following year, he was made his company's head of special developments and started examining design features for a transatlantic airliner.

Von Ohain's turbojet received a German patent on November 9, 1935, and the first model of it was constructed. He met Dr Ernst Heinkel at his home in Warnemünde, a district of Rostock, in March 1936 and the aviation firm boss agreed to both give him a job and pay him royalties on his design.

The following month, having realised that conventional aero engines would be unable to provide the performance his airliner required, Wagner formed a research team led by Max Adolf Müller to work on turboprops – where a gas turbine, rather than a piston engine, is used to drive a propeller.

The first Heinkel demonstration jet engine, von Ohain's HeS 1, was completed by February 1937 and ran successfully a few days later. This caused great excitement within the company and Dr Heinkel ordered that the turbojet programme be accelerated.

In August 1937, aeronautical engineer and gas turbine research enthusiast Helmut Schelp was appointed master of aircraft engineering in the research department of the RLM's Technisches Amt or 'Technical Office'. He was, at this point, unaware that any practical turbojet units were already being developed.

The design of a practical liquid-fuelled flight engine at Heinkel, the HeS 3b, was frozen during the summer of 1938, while Müller's team began bench testing an engine derived from their turboprop – a turbojet.

A few months later, Schelp approached the four main aero engine builders – Daimler-Benz, Junkers Motoren (Jumo), BMW and Bramo – and encouraged them to consider the development of gas turbine powerplants. Daimler-Benz initially refused but the other three accepted research contracts from the RLM.

A meeting of the Lilienthal Society for Aviation Research held in Munich on August 23-24, 1938, had the theme of 'airframes and powerplants' and was attended by 90 specialists from across the German aviation industry. One of the principal lectures was Gas Turbines as the Principal Powerplant for Aircraft by Professor Karl Leist of the DVL's Institute for Powerplants.

While this focused primarily on turboprops, pure turbojets were also discussed. One of the main problems with turbojets at this time was the lack of a sufficiently efficient compressor. The simple centrifugal type used by von Ohain – and also by Whittle – required a larger frontal area and created more drag.

This problem was solved by Walter Encke, the head of the Institute for Aerodynamic Machinery, part of the Aerodynamic Research Institute (AVA) at Göttingen. He designed a highly efficient axial compressor, where the blades acted as aerofoils and were arranged in stages to maintain the correct pressure.

The axial flow compressors used in the first working turbojets produced under RLM contract by both BMW and Junkers were designed by Encke – enabling both engines to be slender and lightweight compared to their British counterparts, produced by Whittle's firm Power Jets.

BMW started work on its first jet engine in 1938 under head of research Dr Kurt Löhner but the design his team produced had a centrifugal compressor and it was cancelled with the outbreak of war so that resources could be concentrated on the BMW 801 radial piston engine. Meanwhile, Bramo had started work at the same time but its design for a counter-rotating axial flow turbojet was more promising.

Bramo merged with BMW in late 1938, however, and its turbojet became the BMW P.3302 – eventually to become the BMW 003.

LEFT: Heinkel got a head start in the jet race by hiring young inventor Hans Joachim Pabst von Ohain who had begun theoretical work on gas turbine powerplants in 1933, aged just 22.
via author

LEFT: Heinkel chief designer Siegfried Günter, left, and company founder Ernst Heinkel himself examine a technical drawing. At first it seemed as though Heinkel had an unassailable lead in jet technology, but as time wore on it became clear that Hans von Ohain was struggling to deliver a fully reliable turbojet. Bundesarchiv Bild 183-1982-1022-509

ABOVE: Dr Herbert Wagner was instrumental in laying the foundations of Junkers' work on gas turbine power plants. This would lead, ultimately, to the most successful German turbojet of the Second World War – the Jumo 004. via author

The RLM's Technical Office urged Junkers to transfer its so-far separate gas turbine development division – Müller's team – to its main engine development division in April 1939. This put Müller into conflict with the conservative head of his company's powerplants arm and as a result he resigned, taking 12 members of his team and a working knowledge of the axial flow compressor over to Heinkel at Rostock.

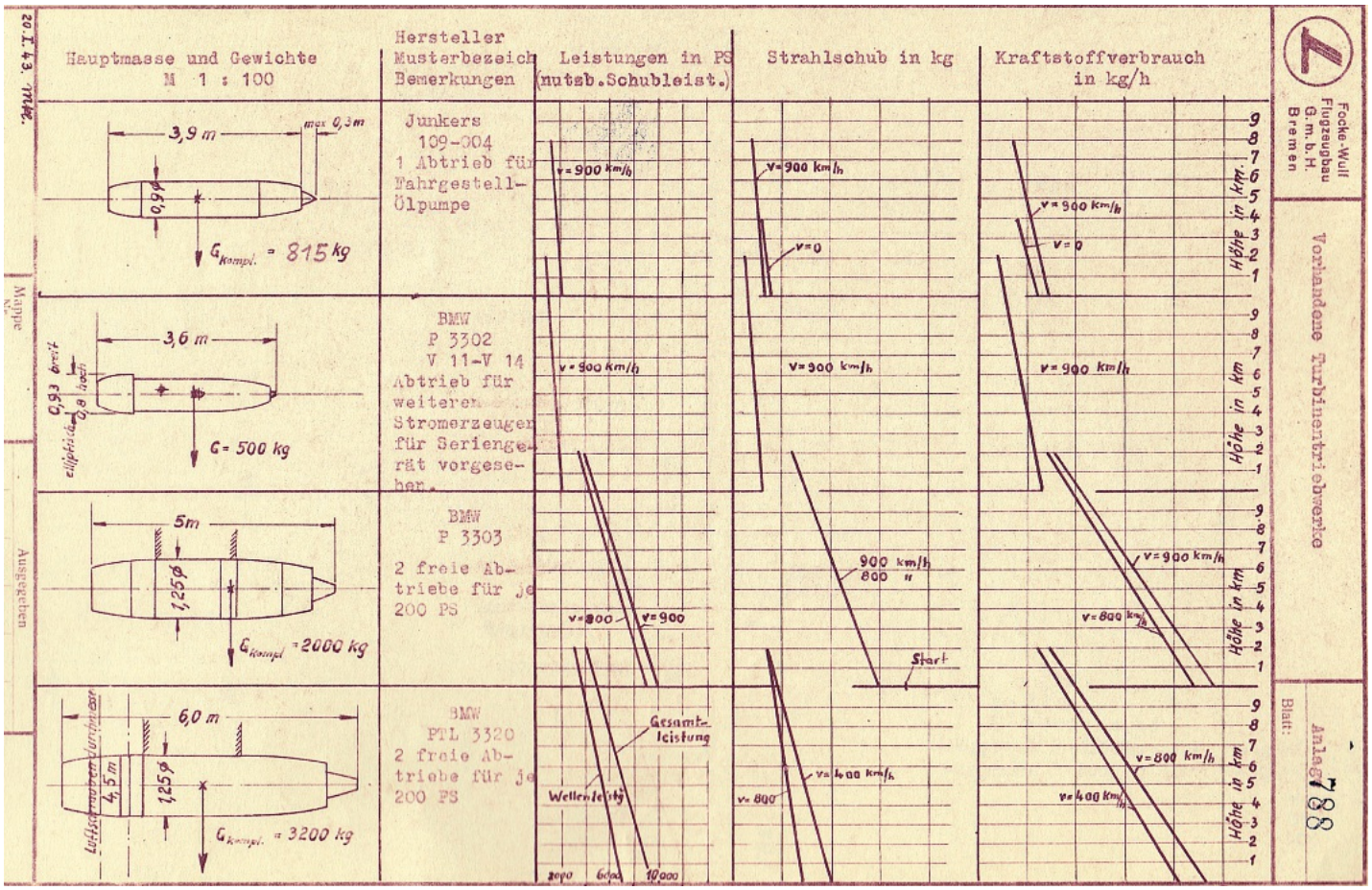
He was replaced by Anselm Franz, who was already head of supercharger research at Junkers. Franz was asked to take over Müller's project but instead he proposed his own design, the T1, later to be developed into the axial flow Jumo 004, for which he received a research contract in July 1939.

Junkers gave Franz all the finance he needed and work began to progress swiftly with a working model produced before the end of the year.

Meanwhile, Heinkel was working on two further engines – the HeS 8, a development of the HeS 3 series, and the axial flow design Müller had brought with him from Junkers, now named the HeS 30.

At the beginning of the Second World War, there were now four promising jet powerplants under development in Germany – Heinkel's HeS 8 (Heinkel 001) and HeS 30 (Heinkel 006), BMW's P.3302 (BMW 003), Jumo's T1 (Jumo 004). Daimler-Benz finally accepted a turbojet research contract before the end of 1939 and it too was beginning to develop jet designs.

With these new powerplants taking shape, the two leading German fighter aircraft manufacturers, Heinkel and Messerschmitt, had been giving much thought what size and shape of aircraft they might propel. ●



ABOVE: Some choice. This Focke-Wulf document from January 1943 makes clear the limited options available to manufacturers seeking to build a turbojet-powered aircraft at that time. Heinkel's engines were not yet being offered to third party aircraft companies, leaving just Jumo's 004 or a selection of dubious BMW projects. GDC

Dawn of the jet fighter

Heinkel He 280

Having begun its own jet engine development, Heinkel was eager to make use of it. The experimental He 178 came first, then the RLM provided a development contract for the world's first single seat jet fighter – the He 280.

With work on Hans von Ohain's HeS 3A engine progressing during early 1938, the Heinkel company set about designing a simple aircraft in which it could be demonstrated.

When the drawings were completed they were submitted to the RLM, which allocated type number 178 to the design. Construction of the He 178 V1 prototype then began towards the end of the year.

In approaching the RLM for type approval, Heinkel had shown its hand and revealed the work that had been going on in secret up to that point. The move invited further discussion and by the end of the year Heinkel and Messerschmitt had been asked to work on fighter airframe designs that could be powered by turbojets.

Both companies were given development contracts by the RLM to proceed with designs for a single-seat jet-propelled fighter and a formal specification was drawn up on January 4, 1939. By June, work on Heinkel's new fighter was at a point where construction of two different full scale mock-ups, plus a fully functioning nose-only weapons mock-up, could begin.

A month later, when work on the He 178 was almost complete, von Ohain's engine was test-flown beneath the fuselage of the piston-engined He 118 V2. The type had been a competitor for the dive bomber contract won by Junkers' Ju 87 but failed when it was found that it could not dive at an angle greater than 50 without disintegrating.

For a brief period, the He 118's main engine was switched off and it flew on jet power alone, before landing using its piston engine again. At around the same time, it was decided that the new Heinkel single-seat jet fighter should have a tricycle undercarriage, with a nose wheel rather than a tail wheel.

With data from the He 118 test in hand, von Ohain's second flight engine, the HeS 3B, was installed in the He 178 – a straight winged aircraft with a round nose intake – and it first flew on August 27, 1939, at Heinkel's own Marienehe airfield.

Less than a month later, on September 26, 1939, representatives of the RLM, the Rechlin aviation technology test centre and the Luftwaffe visited Heinkel to inspect the now-completed jet fighter mock-ups. The Luftwaffe delegation was apparently satisfied by the new type's weapons layout – a trio of MG 151s together in its nose.

Heinkel was asked to modify the mock-up to include a radio system by October 1 but the type met with general approval and was granted the type number 280. A month later, on November 1, the He 178 was flown in front of RLM representatives – showing that the jet engine was indeed a practical proposition, rather than just a theoretical one.

Work on the first He 280 prototype was now under way and firing tests began using the already finished weapons mock-up. The new fighter was intended to have an ejection seat – the first in the world – and testing of this began on June 15, 1940.

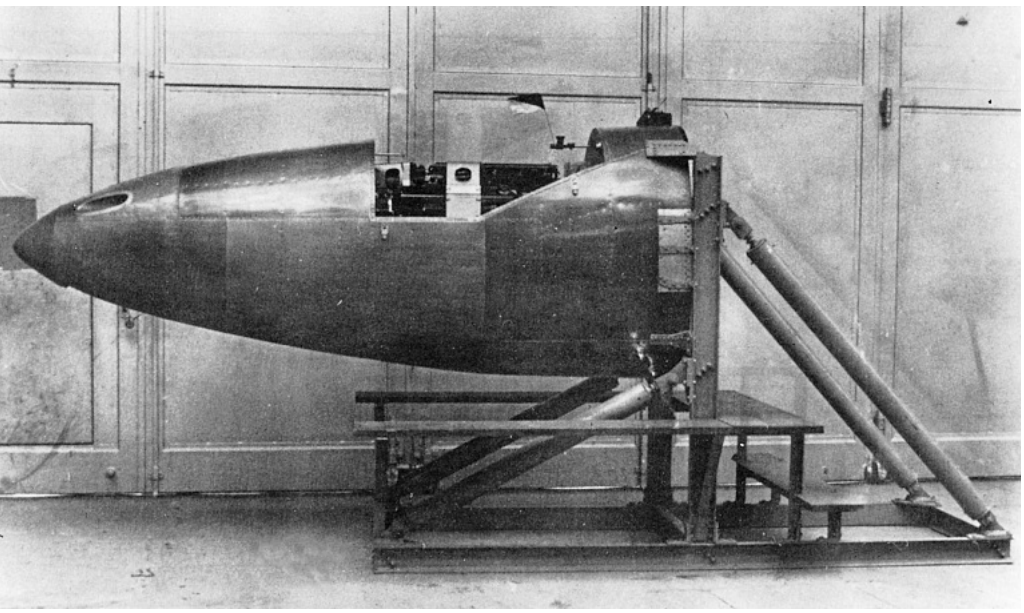
The system, which used compressed air, was used to fire sandbags out of one of the full airframe mock-ups. When this proved successful, it was tested on Heinkel staff members. In total, 75 people tried it out, each being ejected some 6-7m from the mocked-up cockpit.

The Heinkel He 280 V1 was rolled out on August 28, 1940, but remained engineless since von Ohain was struggling to make its intended HeS 8A powerplant sufficiently reliable for flights of more than a few minutes. This was unexpected, since work on the HeS 8A had been ongoing since before the He 178's first flight more than a year earlier.

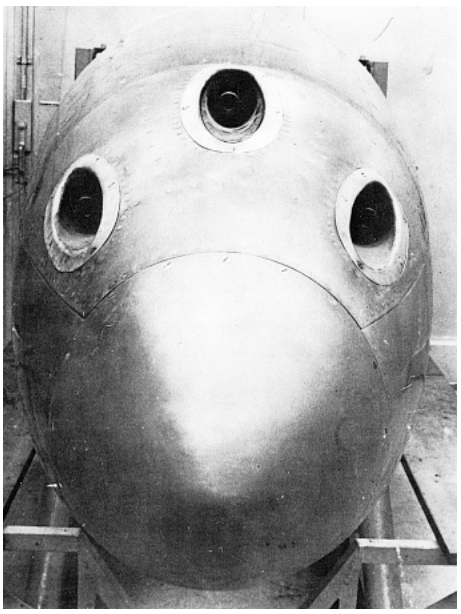
Nevertheless, flight testing began on September 22, 1940, at Rechlin, when the He 280 V1 was towed aloft behind a Heinkel He 111B. The prototype was hauled up to between 8200ft and 13,100ft before the tow cable was released and it was glided back down.

During another flight 18 days later, on October 10, the tow cable was accidentally released before sufficient altitude could be

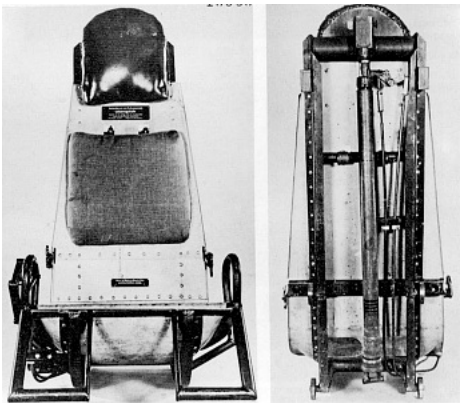
BELOW: Heinkel's He 178 V1 – the first exclusively jet-powered aircraft ever to fly. This historic feat took place on August 27, 1939, at Heinkel's Marienehe airfield. via author



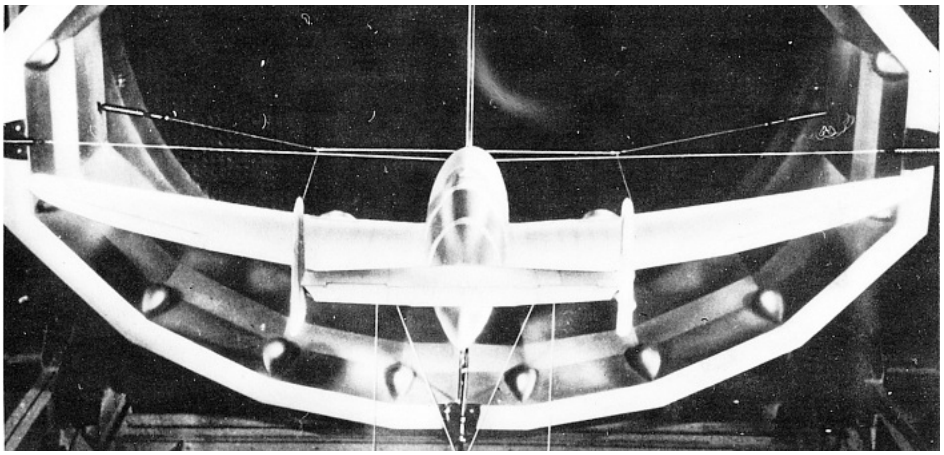
ABOVE: The forward section of a He 280 fuselage mocked-up for static weapons testing. The standard armament at this stage was envisioned as a trio of MG 151/20 cannon. via author



ABOVE: A view of the He 280 weapons test rig from the front – looking down the barrels of its guns. via author



ABOVE: Two views of Heinkel's ejection seat – the world's first – intended for the He 280. Testing began on June 15, 1940, and 75 Heinkel staff members gave it a try. via author



ABOVE: A wind tunnel model of Heinkel's twin-engine jet fighter type, later given the RLM designation He 280. via author

gained and the test pilot was forced to bring He 280 V1 in for a belly landing.

After that, the V1 was brought back to Marienehe so that modifications could be made and further gliding tests took place at the Heinkel works, rather than at the test centre. By the end of the year, however, von Ohain's engine was still not ready. Several dates set for the He 280's first powered flight had already been and gone and concern was beginning to grow about the new powerplant.

On paper, the HeS 8A was capable of producing 1500lb of thrust but von Ohain could only manage 1200lb at 13,000rpm. The chief areas of concern were the radial compressor and the fuel injection jets.

A total of 16 towed flights had been made by the He 280 V1 by December 12, 1940, and the second prototype was close to completion – with its HeS 8A engines fitted. Three further prototypes, He 280 V3-V5, were also under construction.

Finally, more than three months later, on March 30, 1941, He 280 V2 flew under power for the first time. Test pilot Fritz Schäfer trod carefully, not exceeding 155mph, but did not encounter any major problems. He told Heinkel that an rpm indicator was badly needed, and it was difficult to regulate the amount of fuel going into the engines. More controls needed to be developed.

The following month, He 280 V2 was flown to Rechlin for further testing. During the transfer, it was flown up to an altitude of 9800ft and at speeds of up to 400mph – higher than the top speed of the then-latest version of the Messerschmitt Bf 109 fighter, the 109F-4, which topped out at 394mph.

Tests then continued throughout the remainder of 1941 but the He 280 V2's serviceability was generally poor with the engines requiring constant maintenance and replacement parts to keep them going. Fuel leaks were a serious issue and the aircraft was often test-flown without its engine cowlings to prevent a dangerous build-up of fuel within them.

The invasion of the Soviet Union by German forces began on June 22, 1941. After some initial stunning victories, Russian resistance began to stiffen markedly during the second week of July and front line German forces began to suffer significant losses of men and equipment.

Therefore, on July 14, 1941, Adolf Hitler issued Führer Directive No. 32 (Supplement), restricting the allocation of military equipment development contracts. The aim of this pronouncement was to focus the efforts of industry on supplying replacements of existing equipment for combat forces, rather than spending valuable time and resources on research and development.

It suddenly became much more difficult for the RLM to allocate contracts for new aircraft types and its focus narrowed to those advanced types already in development, with a view to getting them into service as soon as possible.

On January 23, 1942, Ernst Heinkel met with von Ohain and his head of design, Siegfried Günter, and told them the RLM had run out of patience. He had been informed that testing of the He 280 was to begin immediately with Argus As 014 pulse jets fitted beneath its wings instead of its usual HeS 8As.

The RLM had also suggested the Jumo 004 as an alternative powerplant – but Jumo itself was still suffering the same sort of severe setbacks being encountered by von Ohain. Reduced to the Argus pulse jet as the only option, representatives of Heinkel visited the Argus works on March 3, 1942, to watch a pair of 014s being run on test rigs.

The As 014 was the invention of engineer Paul Schmidt. He had patented the design a decade earlier and in 1938 had demonstrated his idea of a pilotless flying bomb powered by one of his pulse jets – an idea eventually developed into the V-1. He had been employed by engine maker Argus since 1940 and was close to perfecting the As 014 as his first production model.

Unfortunately, although the As 014 was relatively reliable, it was not very powerful and ▶

ABOVE: The second He 280 takes off without the cowlings of its engine nacelles. The HeS 8A engine was notorious for minor fuel leaks – which could result in a dangerous build-up of flammable liquid within the cowlings over time. via author

ABOVE: The Luftwaffe's director general of equipment, Ernst Udet, tries the He 280 V2's cockpit for size. Udet was a supporter of turbojet technology and apparently the He 280 in particular. via author

eight of them would be needed to get the He 280 off the ground – four under each wing. If the He 280 was still towed aloft however, just two under each wing would be required and flight testing, at least, could become more regular.

In May, the RLM requested that one of the He 280 prototypes be reconfigured to fly using BMW's P.3302. When informed of this, BMW apparently expressed concern that its engine was simply not yet powerful enough for flight testing.

It seemed that all hopes were being pinned on the He 280 at this stage, as on May 29, 1942, the RLM scrapped plans for a lengthy series of prototypes from Messerschmitt and told the firm that only five Me 262 experimental airframes would be needed. At this stage, a series of 24 He 280 prototypes was still on order.

The first delivery of six As 014 pulse jets arrived at Heinkel from the Argus factory in June 1942.

Meanwhile, von Ohain was making more progress with the HeS 8A and a new development, the HeS 8B, was under way. Flight testing of the He 280 V3 with HeS 8A engines commenced on July 5, 1942.

The engine crisis was far from being resolved, however. As the year wore on, it was decided that the pulse jets should be fitted to He 280 V1 for testing at Rechlin. The V2 and V4 airframes would then be reconfigured to fly using the Jumo 004 when working examples were available – the V4 also receiving larger fuel tanks and upgraded weapons. The new weapons load was to consist of either the three MG 151s plus two MG 131s or the same four guns plus a single MK 108 30mm cannon.

In contrast, the Me 262 V3 prototype had regularly begun flight testing reliably with a pair of Jumo 004 turbojets – exactly the sort of performance breakthrough everyone had been waiting for.

In September, Heinkel looked at equipping the He 280 with two HeS 8As and two As 014s. This would, it was hoped, result in a top speed of 534mph – compared to the top speed of 500mph that was anticipated with just a pair of HeS 8Bs. The same number crunching exercise concluded that a He 280 fitted with eight As 014s would have a top speed of just 440mph. Even this would, however, still make it faster than any piston-engine aircraft then in service.

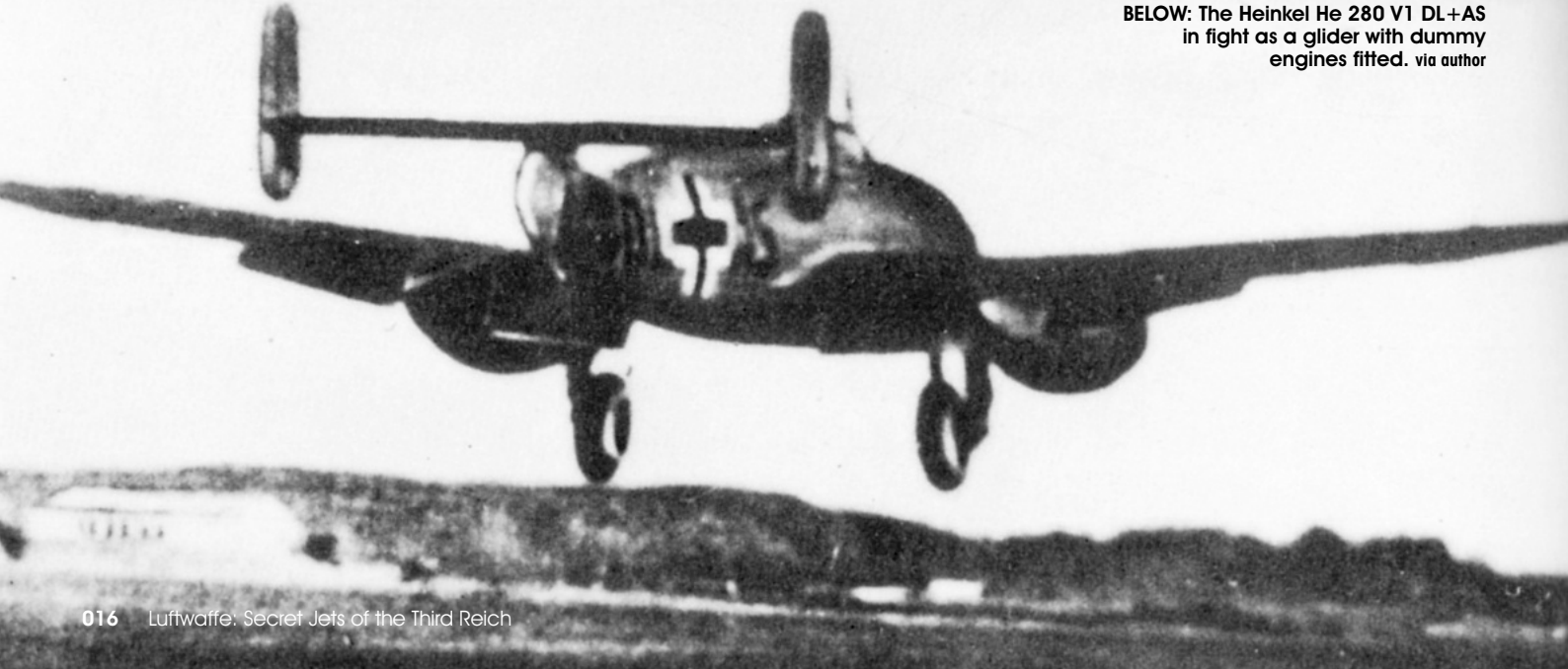
The following month, it became clear that fitting Jumo 004s to the He 280 V2 would not be straightforward since there would simply not be enough ground clearance. A substantial amount of strengthening and lengthening work would also have to be done to the undercarriage of He 280 V4 before it could accept the engines.

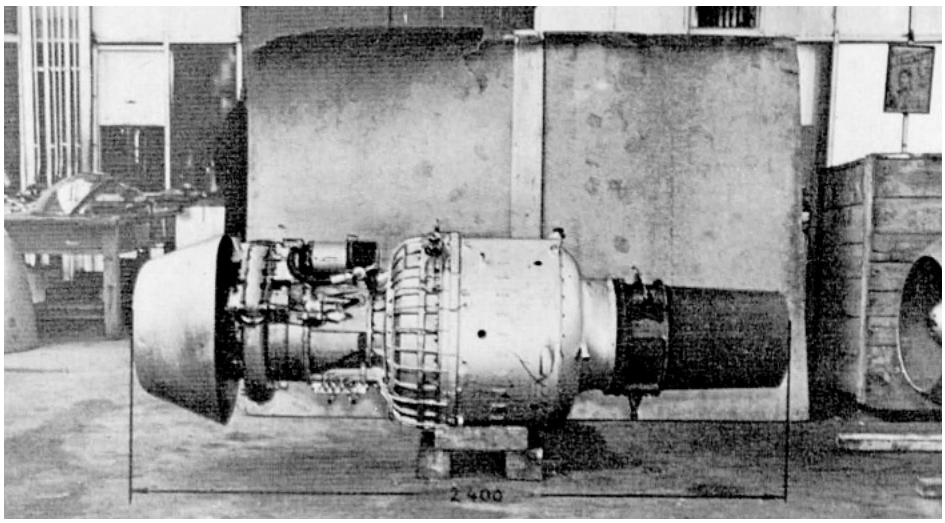
It was also taking longer than expected to satisfactorily fit the As 014 pulse jets to He 280 V1. The work was due to be completed by October 25, 1942, but this deadline passed and the V1 remained incomplete.

On November 18, 1942, the RLM's tolerance of the protracted delays involved with the He 280 programme was nearing its end. Just as it had previously done with the Me 262, it reduced the number of prototypes on order – from 24 down to six, plus one unpowered aircraft for high speed testing. It now seemed as though the Me 262 was the front runner. It had proven that it could fly with its Jumo 004 engines.

Field Marshal Erhard Milch, the man in charge of German aircraft production, made jet development an even greater priority on December 10, 1942, when he effectively overrode Hitler's earlier directive with Projekt Vulkan. This gave five new aircraft types top priority for the procurement of materials and equipment – the Me 163, Me 328, Me 262, Ar 234 and He 280.

BELOW: The Heinkel He 280 V1 DL+AS in fight as a glider with dummy engines fitted. via author





ABOVE: The He 280's troublesome HeS 8A powerplant as viewed from the side. via author

In early January 1943, the RLM held a conference to review the He 280 and Me 262 programmes. A letter sent to the ministry by Heinkel, which promised that BMW P.3302-powered He 280s could be put into series production within six months, was discussed. The number of prototype He 280s required was increased back up to 20 and it seemed as though the aircraft was once again a serious proposition.

At around the same time though, the development programme encountered a serious problem. The As 014 pulse jets had finally been installed on He 280 V1 and it had been taken for its first, towed, flight by an Argus factory test pilot. The airfield at Lärz had been covered with snow and once he got airborne the pilot found that he could not retract the nose wheel. There were also problems with the tow cable and the pilot decided to eject.

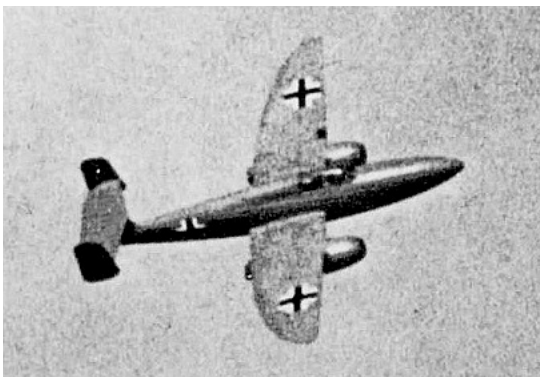
The now pilotless V1, detached from its tow cable, apparently completed two loops before crashing into the ground and behind completely destroyed. On February 8, during a test flight of He 280 V3, a long flame shot suddenly from the rear of the right HeS 8A engine and power fell away dramatically. The test pilot was forced to make a crash landing. The damage was only slight, but it put the only airworthy He 280 out of commission.

Work was also taking place on the He 280 V2 so that it could be fitted with the tried and tested Jumo 004. As expected this was proving to be extremely difficult since, even with substantial modifications, ground clearance would still be poor. To make matters worse, the Jumo 004 was longer than the HeS 8A as well. This made it difficult to land due to the risk of the engines striking the ground to the rear.

With all this no doubt in mind, on March 9, 1943, the RLM decided against series production of the Heinkel He 280. This was officially confirmed in a letter to Heinkel dated March 27, 1943. The Me 262 had won.

Unaware that its contender had already lost the race, Heinkel test flew its He 280 V2 with Jumo 004 engines for the first time on March 15. The take-off took place without problems, but when it was being brought in to land, the landing gear failed to lock into position and the aircraft skidded across the runway at more than 130mph before coming to rest in a nearby field with a damaged nose wheel and bent engine pods.

Plans for series production of the He 280, already well advanced, were halted on March 28, 1943, and its designers were moved over to help those already engaged in working on the troubled He 177 bomber project.

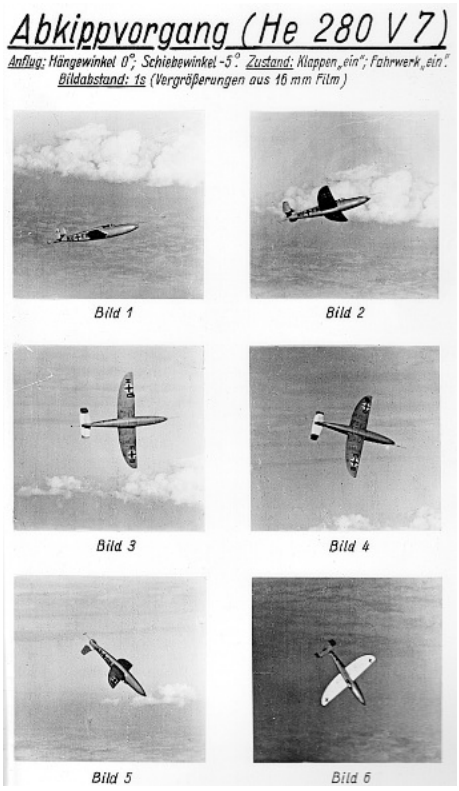


ABOVE: A rare view of the He 280 V3 in flight, powered by a pair of HeS 8A engines. Flight testing began on July 5, 1942, and continued sporadically for seven months. It was halted on February 8, 1943, when the machine was damaged during a crash landing. via author

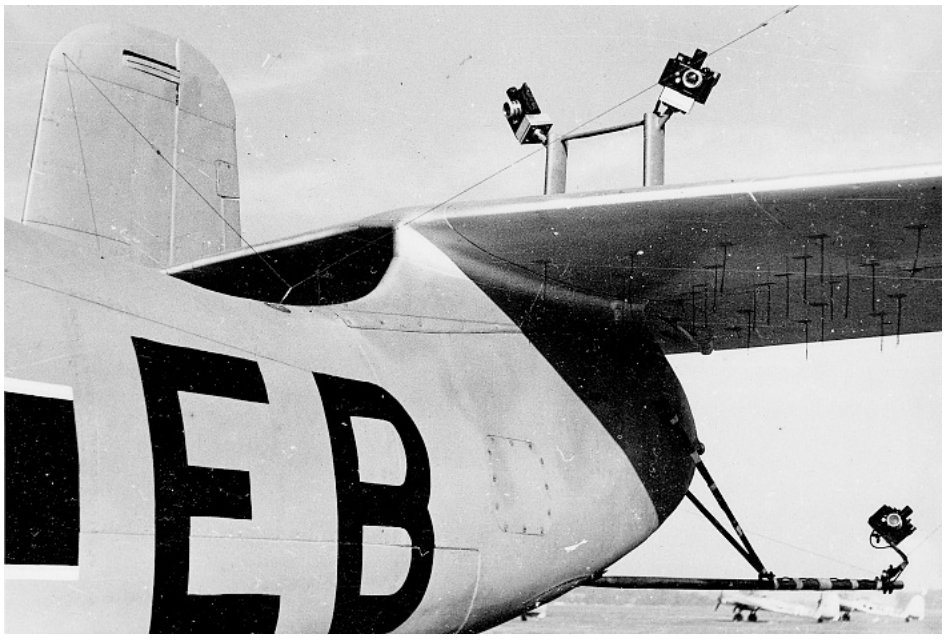
The RLM had, however, allowed for a final total of nine He 280 prototypes. This limited run was now to be used for high-speed testing of the various jets engines.

By this stage, the RLM had also cancelled Heinkel's main in-house jet engine projects too, the HeS 8 – both A and B versions – and the HeS 30, work on which had largely stalled anyway when its volatile ex-Junkers creator Max Müller had argued with Ernst Heinkel and resigned from the company in May 1942.

There was a little good news for Heinkel though. The RLM still wanted von Ohain and his team to continue working on what was shaping up to be the best jet engine on anyone's drawing board – the HeS 011. ●



ABOVE: Long after the He 280 programme had been cancelled, in 1944, the V7 airframe was used as a glider for towed pitch testing. It made a total of 115 flights and gathered valuable data that helped Heinkel during its work on the He 162. GDC



ABOVE: Close-up of the He 280 V7's tail rigged with camera equipment for pitch testing. GDC

The greatest success

Messerschmitt Me 262

Starting out primarily as a rival for the He 280, the Me 262 went through many of the same development problems and many of the same solutions were suggested to its designers. It was the underdog for a time but eventually came out on top and went on to become a legend...

LEFT: An early wind tunnel model of the P.1065 with the engine nacelles built into the wing, rather than slung beneath it, and a graduated sweepback. via author

When Heinkel submitted its drawings of what became the He 178 to the RLM, along with the test data showing why and how it would work, it became clear that the new turbojet powerplant was a viable proposition.

Heinkel and Messerschmitt were natural choices to design a fighter based around the new powerplant since both had been front runners in the 1936 fighter competition which eventually saw the latter's Bf 109 beat the former's He 112 fighter to mass production.

Messerschmitt's jet project, begun with the allocation of an RLM development contract at the end of 1938, was given the company designation P.65 – changed to P.1065 when the company later altered its numbering system.

Early on, the firm attempted to design a single-engine jet fighter with the powerplant in a central fuselage between two booms – like de Havilland's Vampire – before switching to something akin to Heinkel's He 178 with a nose intake.

When it became obvious that the power output of the engines most likely to be available would fall well short of initial hopes, Messerschmitt adopted a twin-engine layout as the most straightforward and practical design, a move that mirrored similar thinking at Heinkel.

With this basic shape as a template, the Messerschmitt team began more detailed work on April 1, 1939. An initial design submitted to the RLM on June 7, 1939, featured wings similar to those of the Bf 109 but the RLM nevertheless asked for mock-ups to be constructed. From the end of September, a new and larger wing was introduced since calculations showed that this would bring significantly improved performance during take-off and landing.

The finished mock-ups were given an RLM inspection on December 19, 1939, and a project description issued in February 1940 showed two BMW P.3302 positioned under the wings, which themselves were now swept back by 18 degrees.

A series of 20 P.3302-powered prototypes of the P.1065 was proposed on March 1, 1940, though the production model would get the much smaller and more advanced BMW P.3304. Armament was to be a trio of MG 151 20mm cannon in the nose – the layout already settled on by Heinkel six months earlier – and also like the He 280 the Me 262 was to have an ejection seat and a pressurised cabin. It was also proposed that dive brakes would be installed.

Unlike the He 280, the P.1065 was a 'tail-sitter' – with a tailwheel instead of a nose wheel. It had not firmly been decided that the engines would be slung beneath the wings, however, and variations with the engines mounted centrally within the wings or even mounted atop them were examined.

Just as Heinkel was struggling with its in-house engine designs, so too was Messerschmitt frustrated by BMW's difficulties in making the P.3304 work. By January 1941, the situation was becoming desperate. The He 280 had already begun flight testing four months earlier – albeit under tow – whereas the P.1065 did not even exist as a prototype.

Messerschmitt therefore proposed the use of a Jumo 210G piston engine, fitted in the P.1065 V1's nose, bolstered by a pair of Walter R II 211 rocket engines. This plan, with four other prototypes to follow, was approved and P.1065 V1 was built between February and March 1941.

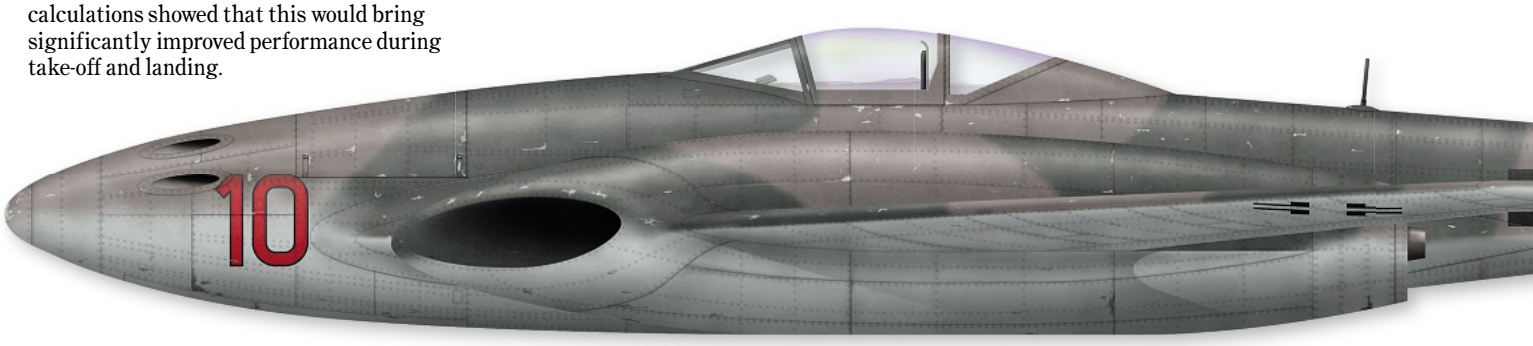
The P.1065 received the official RLM designation Me 262 on April 8 and 10 days later the newly renamed Me 262 V1 flew for the first time – though only powered by its Jumo piston engine. The He 280 V2 had flown with jet engines nearly three weeks earlier.

The RLM confirmed the Me 262 V1-V5 series and also approved the building of 20 pre-production machines on July 21, 1941 – perhaps inspired by Hitler's ban on development contracts for new types a week earlier and the accompanying drive to push on with existing advanced types already being worked on.

Two BMW P.3302 prototype engines were delivered to Messerschmitt in September 1941 and it took until December to get them fitted. In the meantime, Messerschmitt began to consider Argus As 014 pulse jets fitted beneath the Me 262's wings instead of BMW turbojets.

Configurations with three or four under each wing were examined and proposals were drawn up on October 16, 1941 – three months before Heinkel was informed that it would have to take the same measures.

The sole Me 262 prototype, V1, was used to ground test Heinkel's ejection seat in February 1942, but this work was quickly abandoned,



probably because V1 was needed for further flight testing.

Having taken off 47 times on its piston engine alone, V1 took off again on March 25, 1942, this time with the P.3302 prototypes under its wings. It was an important moment and all eyes were on Messerschmitt test pilot Fritz Wendel as he lifted the aircraft off the runway at Augsberg – only for both jet engines to immediately fail due to compressor blade failure.

Wendel managed to get back on the ground safely with just the Jumo piston engine but the damage to the Me 262's reputation was already done. The RLM scrapped the order for 20 pre-production Me 262s on May 29, 1942, only keeping the initial request for five prototypes. There were still 24 He 280s on order.

Just three days later, a pair of Jumo 004 engines were delivered to Messerschmitt and over the next six weeks they were fitted to Me 262 V3. On July 18, Wendel flew the aircraft for 12 minutes without problems in the morning, then flew it for another 13 minutes at around midday, managing to reach 342mph. More successful flights followed but on August 11, with Heinrich Beauvais, chief fighter aircraft assessor for the Rechlin test centre, at the controls Me 262 V3 crashed on take-off, causing substantial damage.

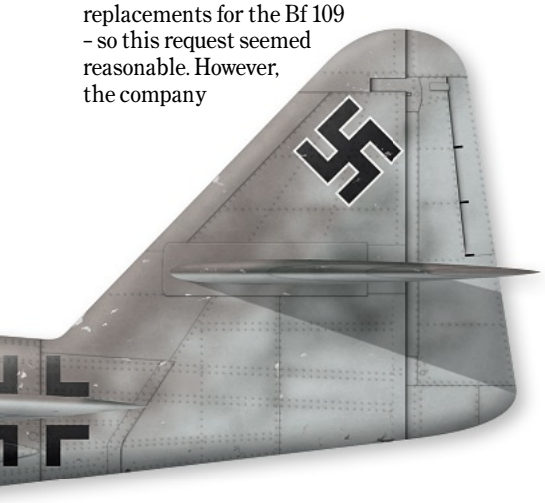
Despite this, the Me 262 V3's sustained success with its Jumo 004s was the first real evidence that all the time, effort, money and, above all, faith, invested in jet fighters was going to pay off. The sense of relief must have been palpable. The Me 262's series of pre-production aircraft was reinstated and it was quickly decided that Me 262 V2, which had been built for BMW P.3302 engines, should be converted to Jumo 004s by the end of September.

V3 was to be put back together and V4 and V5, also on Jumos, would need to be ready by January and March of 1943. Work on building V6 would begin in May 1943.

V2 flew with Jumo 004 engines twice on October 1, 1942, and the RLM increased its order to 30 pre-production aircraft – but all of them reconfigured to accommodate He 280-style tricycle undercarriages.

Messerschmitt had been working on a tricycle type undercarriage of its own for the Me 309 – one of several potential replacements for the Bf 109 – so this request seemed reasonable. However, the company protested that it would be unable to produce 30 Me 262s before the end of 1943.

Not only that, Willy Messerschmitt himself considered that the Me 262, now that its future as a viable type seemed secure, was three years out of date. The whole airframe would need to be reassessed and redesigned – an idea that thoroughly dismayed the RLM, which wanted a completed production-ready version of the Me 262 as soon as possible. ▶



ME 262 VARIANTS

The tale of the Me 262's development does not end with it entering full production and front line service. During 1944 a whole host of different versions were planned and built.

- **Me 262A-1a –** the standard fighter with 4 x MK 108.
- **Me 262A-1a Jabo –** the standard fighter with the addition of either one or two bombs mounted on ETC 503 nose racks.
- **Me 262A-1a/U1 –** the standard fighter but with six guns in its nose instead of four: 2 x MG 151/20 20mm cannon at the top, 2 x MK 108 in the centre and 2 x MK 103, positioned either side of the MK 108s with their barrels protruding. Only one prototype built.
- **Me 262A-1a/U2 –** the standard fighter with all-weather kit such as a FuG 125 Hermine VHF radio beacon signal receiver. It was also planned to fit it with a K22 autopilot and a FuG 120 Bernhardine set for ground to air communications. Possibly none built.
- **Me 262A-1a/U3 –** interim reconnaissance version with two Rb 50/30 cameras in the nose. Teardrop shaped fairings fitted over the parts of the bulky cameras that won't fit within the fuselage. Two glazed panels, one either side of the nosewheel well, installed for the camera lenses. A single MK 108 fitted in the centre of the nose in front of the cameras, with the barrel protruding.
- **Me 262A-1a/U4 –** massive long range 50mm MK 214 cannon fitted in nose. Two prototypes completed – WNr. 111899, which first flew on March 19, 1945, and WNr. 170083, which probably never flew before being captured by the Americans in May 1945.
- **Me 262A-1a/U5 –** standard fighter but with 6 x MK 108 fitted, the usual four plus two more right at the front of the nose with their barrels protruding. One prototype built, WNr. 112355.
- **Me 262A-2a –** similar to A-1a Jabo but with only two MK 108s. It also offered the option of three different bomb racks to allow a wide range of munitions to be employed.
- **Me 262A-2a/U1 –** standard A-2a but with TSA 2D bomb aiming device fitted.
- **Me 262A-2a/U2 –** originally known as the A-2a/U1, then the A-3a, then finally becoming the A-2a/U2, this much modified version of the A-2a had an enlarge nose with a glass bulb at the end where a second crewman, a bomb aimer, could lie prone and use a Lofte 7H3 bombsight. No defensive armament. Two prototypes completed, WNr. 110484 and WNr. 110555.
- **Me 262A-3a –** standard fighter but with an armoured box within the fuselage to protect the pilot. No prototypes completed.
- **Me 262A-4a –** another interim reconnaissance version with either no defensive armament and two Rb 50/30 cameras or 2 x MK 108 and a single SSK camera. Number produced unknown but possibly up to three prototypes.
- **Me 262A-5a –** reconnaissance version with 2 x Rb 50/30 cameras and 2 x MK 108 cannon, each with 66 rounds. Teardrop shaped fuselage bulges over the cameras were larger and longer than those of the A-1a/U3.
- **Me 262B-1a –** standard A-1a converted to two-seat trainer with smaller rear fuel tanks fitted, creating room for an instructor's seat and a set of dual controls. Full armament of 4 x MK 108 retained. 67 built.

The following designs, with the exception of the Me 262E-1, fit into competitions held during 1944 and are therefore discussed in more detail elsewhere in this publication:

- **Me 262B-1a/U1 –** interim night fighter.
- **Me 262B-2a –** night fighter.
- **Me 262C-1a –** Heimatschützer I (Home Defender I).
- **Me 262C-2b –** Heimatschützer II (Home Defender II).
- **Me 262C-3a –** Heimatschützer IV (Home Defender IV).
- **Me 262D-1 –** Later redesignated Me 262C-2b.
- **Me 262E-1 –** Full production version of Me 262A-1a/U4. Never built.

ABOVE: Messerschmitt test pilot Fritz Wendel powers up the Me 262 V3 ahead of his historic flight at Leipheim on July 18, 1942. This image is a still from a cine film. via author

LEFT: The ultimate aerodynamic development of the Messerschmitt Me 262 – the HG III. It was to be powered by a pair of HeS 011 engines buried in its wing roots, its wings had a 45 degree sweep-back and its pilot sat beneath a low profile Rennkabine or 'racing cabin' canopy. Art by Chris Sandham-Bailey

LEFT: General of Fighters Adolf Galland test-flew the Me 262 V4 on May 22, 1943, and famously told Hermann Göring that: "It flies as if there is an angel pushing."

BELOW: It is difficult to underestimate the importance of Messerschmitt Me 262 V3. By the time the aircraft was ready, the German government was losing faith in jet engine development. Heinkel and BMW both seemed unable to deliver anything close to sufficient reliability for a full production model and it was left to Jumo to rescue the Me 262. The V3 flew successfully for 12 minutes on the morning of July 18 using turbojet power. It then flew for another 13 minutes at around midday – reaching 342mph. The Heinkel He 280 was doomed, the Me 262's future was assured and faith was restored in the turbojet programme. via author

In order to gain some time for the Me 262, on January 22 Willy Messerschmitt proposed a jet-powered version of the Bf 109 as an interim measure, the Bf 109TL. This was to have the tricycle undercarriage and wings of the Me 309 – cancelled just eight days later – and the fuselage of the Bf 109-based Me 155 naval/high altitude fighter. Only the nose, tail and wing pods housing Jumo 004s would be entirely new.

This plan was rejected because it would take just as long to implement as the redesign of the Me 262. On March 4, 1943, a meeting was held to review the armament of the Me 262 and it was decided that the originally proposed trio of MG 151 20mm cannon should be replaced with six MK 108 cannon or two MK 108s and a pair of MG 151s.

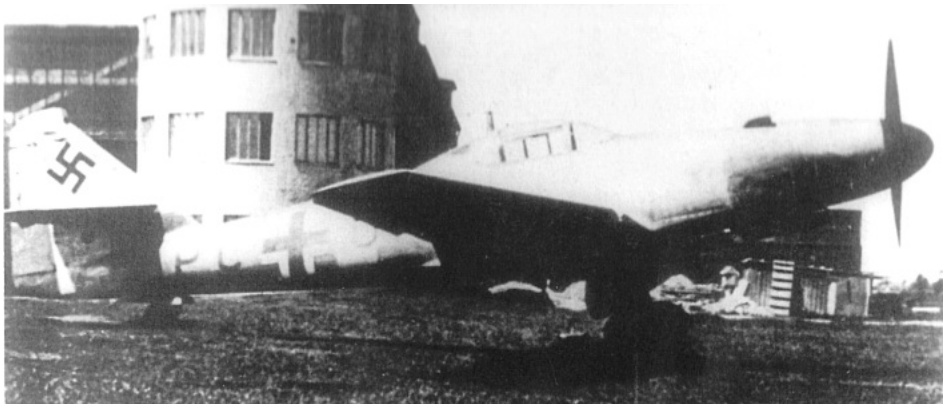
Five days later, and with news that a new lighter version of the Jumo 004 was nearing completion, the decision was taken to cancel Heinkel's He 280 and press ahead with the Me 262 as the Luftwaffe's first mass-produced jet fighter.

The Me 262 V2 was still the only version flying but it was joined on March 20 by the fully repaired V3 – just as well since V2 was completely destroyed in a crash during its 48th flight on April 18. V4 was completed on May 15, 1943.

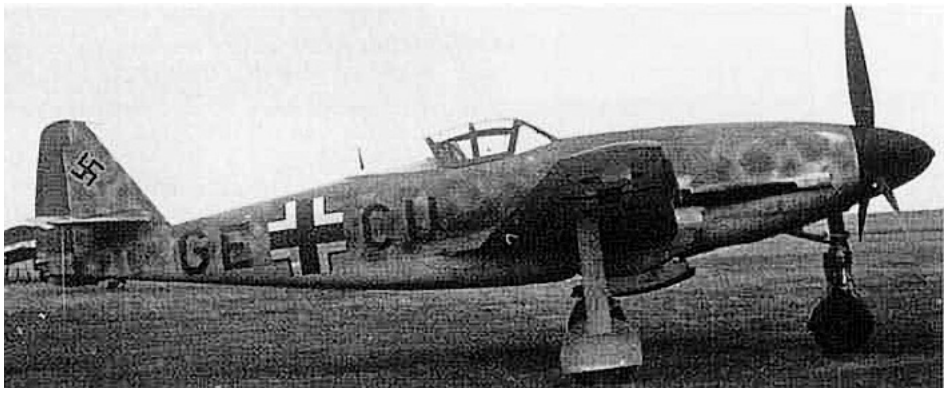
With the He 280 out of the race, it now had to be decided whether to build the Me 209 in quantity to replace the Bf 109 or to put the Me 262 onto production lines instead. The decision was down to Erhard Milch and in order to help him make up his mind he asked his trusted friend and colleague Adolf Galland, General of Fighters, to evaluate the Me 262.

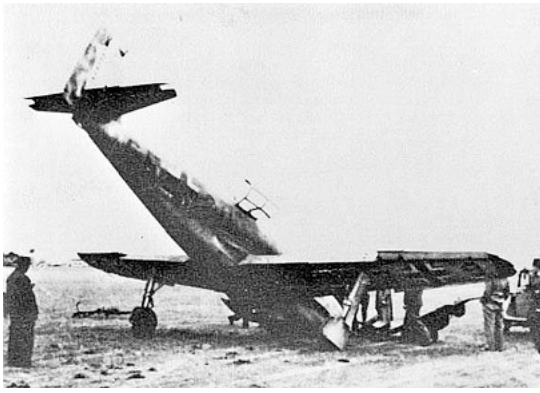
The Me 209 was the safe choice – essentially an upgraded version of the Bf 109G with a larger engine, longer wings and fuselage, and wide-track landing gear – but compared to the Me 262 little attention had been lavished upon it.

Galland test-flew the Me 262 V4 on May 22, 1943, and quickly became the type's most



ABOVE AND LEFT: Few photographs of the Messerschmitt Me 262 V1 exist. It was fitted with a Jumo 210G driving a twin-bladed propeller. via author





ABOVE AND RIGHT: While the early Me 262 prototypes were all tail-sitters, it had been envisioned as early as 1939 that the type should have a tricycle undercarriage. Unfortunately, engineering a nosewheel that worked proved more difficult than the company's designers had imagined. It was first tried out on the Me 309 fighter, an intended replacement for the Bf 109, but proved to be overly weak. via author

ardent and influential supporter. He famously reported to Reichsmarschall Hermann Göring that: "It flies as if there is an angel pushing." Nine days later, Göring officially declared that production of the Me 209 was to be suspended in favour of the Me 262.

Me 262 V5, the first prototype to be fitted with a tricycle undercarriage, first flew on June 6, 1943, and demonstrated a marked improvement in take-off performance compared to the earlier 'tail dragger' versions.

Messerschmitt drew up a production plan on June 17 showing production of the Me 262 beginning in January 1944 but Milch, desperate for the Me 262 to reach front line service, ordered that the first 100 aircraft should be ready by the end of 1943.

Me 262 V3, V4 and V5 were joined by V1 on July 10, 1943. Since its days as a propeller-engined test vehicle for BMW's woefully unready P.3302, V1 had been rebuilt with Jumo 004s – plus the first pressurised cabin to see service in a Me 262 and a trio of MG 151s in the nose, making it the first armed Me 262.

Used to carry out firing trials on the ground initially, V1 first flew in its new configuration on July 19. The following day, V5 was fitted with two Rheinmetall-Borsig 109-502 booster rockets attached side by side beneath its rear fuselage. When they were correctly aligned, these reduced the Me 262's take-off run by nearly 1000ft.

Milch and Göring were invited to watch Me 262 V4 fly on July 25, 1943, at Rechlin. It performed successfully but was then badly damaged the following day when it crashed during take-off.

Then a burst nosewheel tyre during landing put Me 262 V5 out of action on August 4, 1943, leaving the company with just V1 and V3 with which to continue test flights. There was another disaster on August 17 when Messerschmitt's Regensburg factory was badly damaged during a US Eighth Air Force bombing raid.

Some 400 people died and many of the jigs and gauges required for Me 262 production were destroyed. Key Messerschmitt personnel were then relocated to a former Gebirgsjäger barracks east of Oberammergau in the Bavarian Alps – causing the Me 262 development programme significant delays.

The Allies were unaware of this move and the new facility was never on the receiving end of a US bomber raid as a result. The Messerschmitt name was world famous, so the Oberammergau facility went by the anonymous sounding 'Oberbayerische Forschungsanstalt' or Upper Bavarian Research Establishment instead.

PLANNING AHEAD

While all this was going on, Messerschmitt's design office was working on a new study. Experience with the Bf 109 had demonstrated that a mass-produced front line Luftwaffe aircraft was likely to be called upon to perform a wide range of roles beyond that of pure fighter.

Therefore, between July and August 1943, the company's engineers and draftsmen worked on an array of designs showing how the basic Me 262 platform might be developed to perform a whole host of different tasks. The resulting report published on September 11, 1943, shows the standard Me 262A-1 fighter compared against a fighter-bomber 'Jabo' version, three 'Schnellbomber' fast bomber versions, three 'Aufklärer' reconnaissance versions, three 'Interzeptor' interceptors and a 'Schulflugzeug' trainer version.

The Schulflugzeug had a lengthened fuselage with room for instructor and pupil to sit in tandem with dual controls. There was no armament – its place being taken by 330lb of ballast.

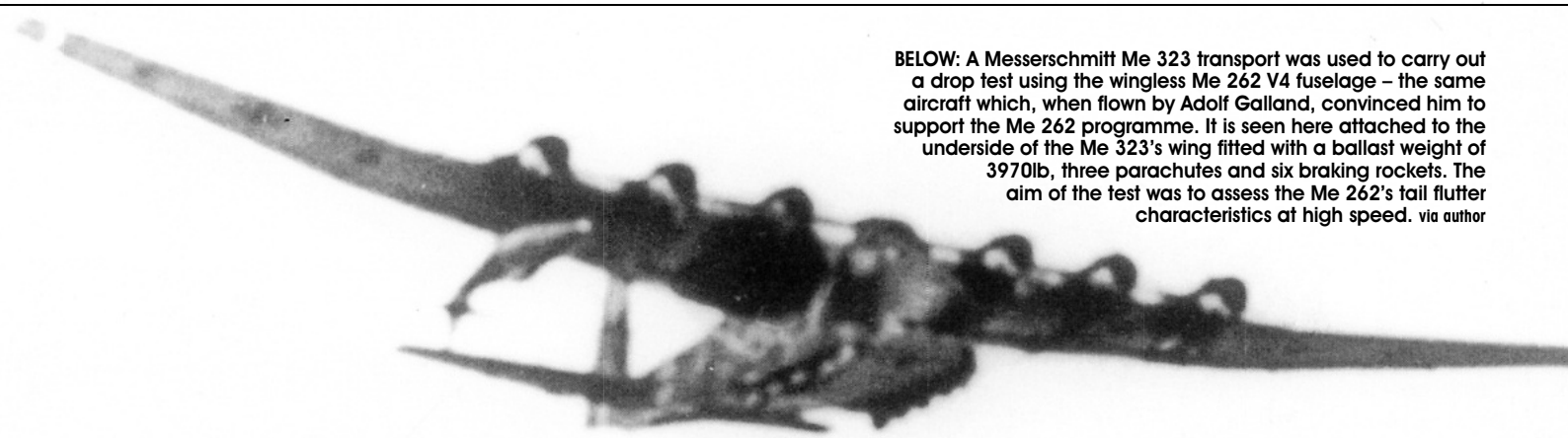
The fighter-bomber version, described as 'Jäger u. Jabo', was what evolved into the Me 262A-2a – similar to the normal fighter but with six MK 108s in the nose rather than four, an extra 750 litre fuel tank in the rear fuselage and the ability to carry either one 1100lb bomb or two 550lb bombs under its forward fuselage. The production A-2a had only two MK 108s.

The Schnellbomber I looked like the A-1 fighter but had no weapons other than its bomb load – which could be one 1000kg bomb or two 500kg bombs, or two 250kg bombs. A fourth option was a single BT 700 torpedo bomb. Instead of cannon it had a 1000 litre fuel tank in its nose. A second 1000 litre tank was installed in the rear fuselage.

In contrast, Schnellbomber Ia took a radical departure from the familiar Me 262 shape – with the cockpit moved to the nose and the rest of the fuselage filled with fuel tanks. Two MK 108s could apparently be accommodated beneath the pilot. The potential bomb loads remained the same.

Schnellbomber II was another departure from the usual Me 262 form. This time, the forward fuselage was significantly deepened to form what amounted to an ▶

BELOW: Me 262 V6 was the first Me 262 prototype to be fitted with a fully retractable tricycle undercarriage. via author



BELOW: A Messerschmitt Me 323 transport was used to carry out a drop test using the wingless Me 262 V4 fuselage – the same aircraft which, when flown by Adolf Galland, convinced him to support the Me 262 programme. It is seen here attached to the underside of the Me 323's wing fitted with a ballast weight of 3970lb, three parachutes and six braking rockets. The aim of the test was to assess the Me 262's tail flutter characteristics at high speed. via author

aerodynamic fairing over its bomb payload – which comprised the same four options available to the other two Schnellbombers. As with Schnellbomber I, there was no provision for defensive armament.

The layouts of the trio of Aufklärer versions followed the same pattern. The Aufklärer I looked like an A-1 but had a 500 litre fuel tank inside its nose, and immediately behind that a pair of cameras – either an Rb 75/30 and an Rb 20/30 or two Rb 75/30s. The Aufklärer Ia, like its Schnellbomber counterpart, had its pilot sitting in its nose – potentially accompanied by a pair of MK 108s. The cameras, two Rb 75/30s being the only option, would be fitted in the rear fuselage.

Aufklärer II had the bulbous fuselage of the Schnellbomber II, allowing it to carry three cameras – an Rb 20/30 and two Rb 75/30s in the end of its nose. The underhanging section of the fuselage would be used to house a 1450 litre fuel tank.

There would be no layout changes for the three Interzeptor designs. Each was configured for maximum speed and rate of climb and that meant the inclusion of rocket engines. They all carried four MK 108s in the nose and all had extra main undercarriage wheels that were designed to be jettisoned after take-off to save weight and reduce complexity.

Interzeptor I had the Me 262's usual Jumo 004s supplemented by a Walter R II/211/3 rocket motor mounted inside its tail. Interzeptor II had a pair of BMW 003R engines in place of the Jumo 004s in its wings. The BMW 003R was a composite of a normal BMW 003 turbojet and a BMW P.3395 rocket engine, the latter running on concentrated nitric acid (SV-Stoff) and monoxylidene oxide/triethylamine (R-Stoff), rather than the methanol-hydrazine-water mixture (C-Stoff) and hydrogen peroxide (T-Stoff) used for Walter-type rockets.

Lastly, the Interzeptor III was to be a pure rocketplane – powered by a Walter HWK 509 rocket engine under each wing.

In addition to the normal Me 262A-1 fighter, the Jabo was built as the Me 262A-2, the Schulflugzeug as the Me 262B-1, the Interzeptor I as the Me 262C-1 and the Interzeptor II as the Me 262D-1, later redesignated Me 262C-2.

INTO SERVICE

Me 262 V6 was the first Me 262 prototype to be fitted with a fully retractable tricycle undercarriage, and it made its first flight on October 17, 1943.

V6 was also armed, with the now familiar trio of MG 151s, and was powered by the Jumo 004B – a jet engine similar in size and shape to its 004A predecessor but weighing 240lb less – a combined saving across the two engines of 480lb.

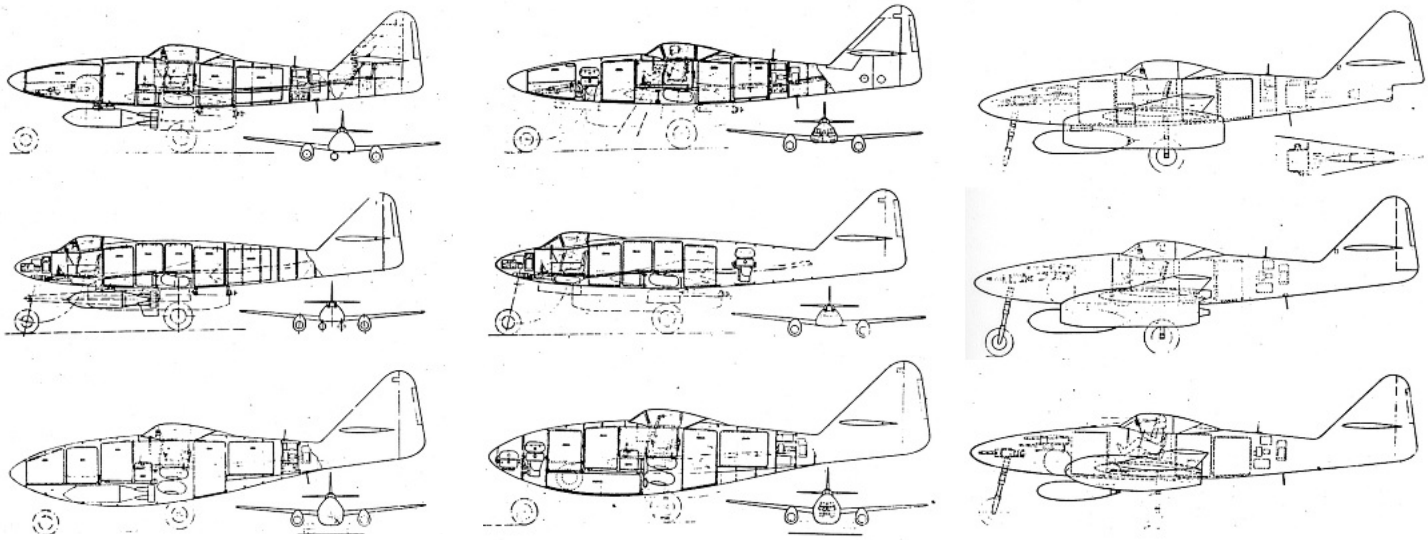
Less than a week later, on October 23, the cleaned up fuselage of V4 was put to further use when, suspended beneath the wing of a Me 323 Gigant transport, it was taken up to 23,000ft and dropped.

The V4 had been fitted with a ballast weight of 3970lb, three parachutes and six braking rockets. The object of its freefall descent was to test its tail flutter characteristics at high speed without having to subject Messerschmitt's test pilots to a potentially life-threatening structural failure.

When the test vehicle had reached 541mph and was nearing the ground, the control team on the ground remotely jettisoned its ballast using radio-activated explosive bolts, fired the rockets and attempted to open the parachutes. However, only one of them opened successfully and V4 was destroyed when it crashed into Lake Constance at 509mph.

On October 27, 1943, Hitler emphasised the role he envisioned the Me 262 playing during the long-anticipated Allied invasion of France. He said: "The jet fighter with bombs will be vital, because at the given moment it will scream at top speed along the beaches and hurl its bombs into the massive build-up that is bound to be there."

At a display of the Luftwaffe's latest experimental equipment on November 26 at Insterburg airfield, East Prussia, Hitler went to inspect the two Me 262s on show – V1 and



ABOVE LEFT: The three designs for Me 262 'Schnellbombers' or 'fast bombers' first published in September 1943. They are, from top, Schnellbomber I, Ia and II. ABOVE MIDDLE: Similar to the three Schnellbomber layouts, and from the same report, were the Aufklärer or reconnaissance versions (from top) – I, Ia and II. Messerschmitt toyed with a variety of different arrangements of cockpit and fuselage for the Me 262 – including designs with the cockpit at the extreme rear of the aircraft, built into the fin. ABOVE RIGHT: The three Messerschmitt Me 262 'Interzeptors'. From the top they are versions I, II and III. The first two were built as prototypes but the third, a purely rocket-powered machine, never left the drawing board. TNA

V6. Indicating them, he said: "I'm not interested in this aircraft as a fighter. Can it carry bombs?"

Willy Messerschmitt assured him that it could – one 1000kg bomb or two 500kg bombs. Hitler then said: "At last, this is the aircraft I have been demanding for years. Here it is, but nobody recognised it. I order this aircraft be built as a bomber."

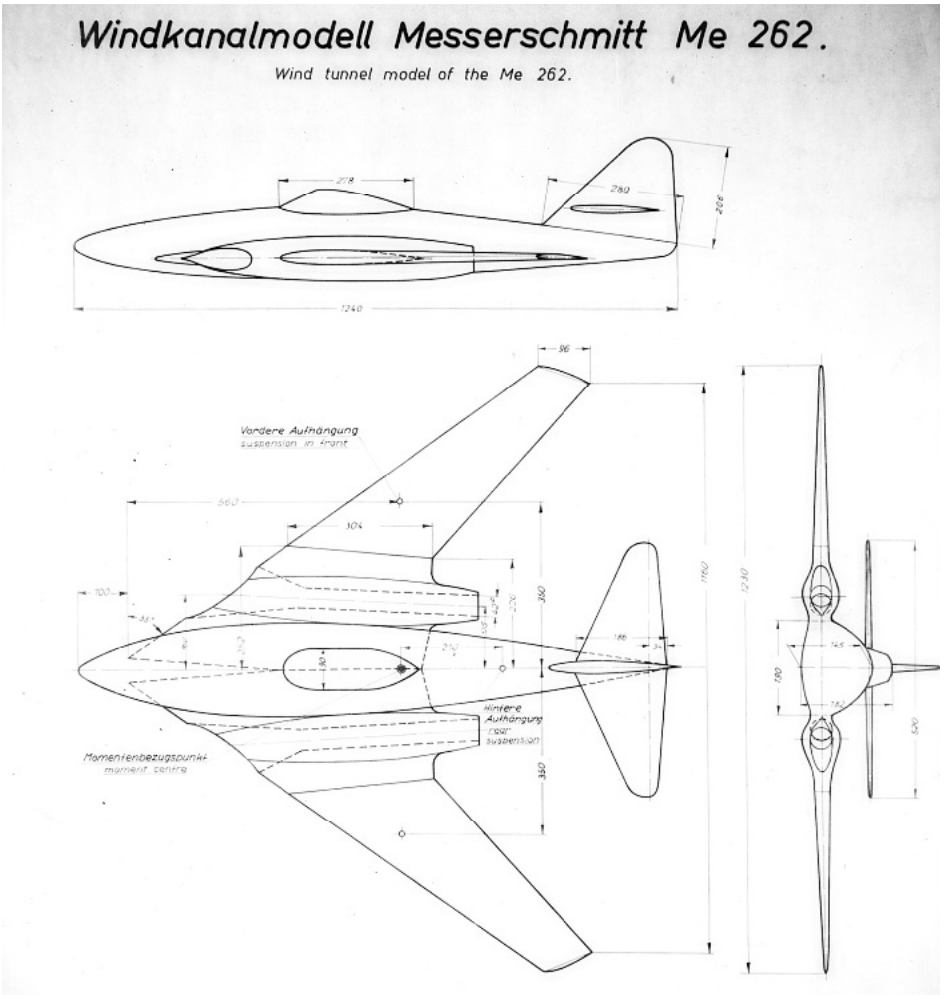
In anticipation of just such an order, Messerschmitt had already devised its three Schnellbomber options for turning the Me 262 into a 'fast bomber' exactly as Hitler wanted. Whether any of the three could actually reach serial production any time soon was another matter entirely, however.

The Me 262 V7 first flew on December 20, 1943, with all the same innovations as the V6 but with the addition of a rubber-sealed pressure cabin. It was followed by the V9 on January 19, 1944, which was used to test the new bubble cockpit canopy and radio and electrical equipment.

V8 was completed on March 18 and was to be the A-series production prototype. In most respects it was similar to the V9 but had a quartet of MK 108 30mm cannon in the nose – what was to soon become the well-known standard armament of the Me 262A-1.

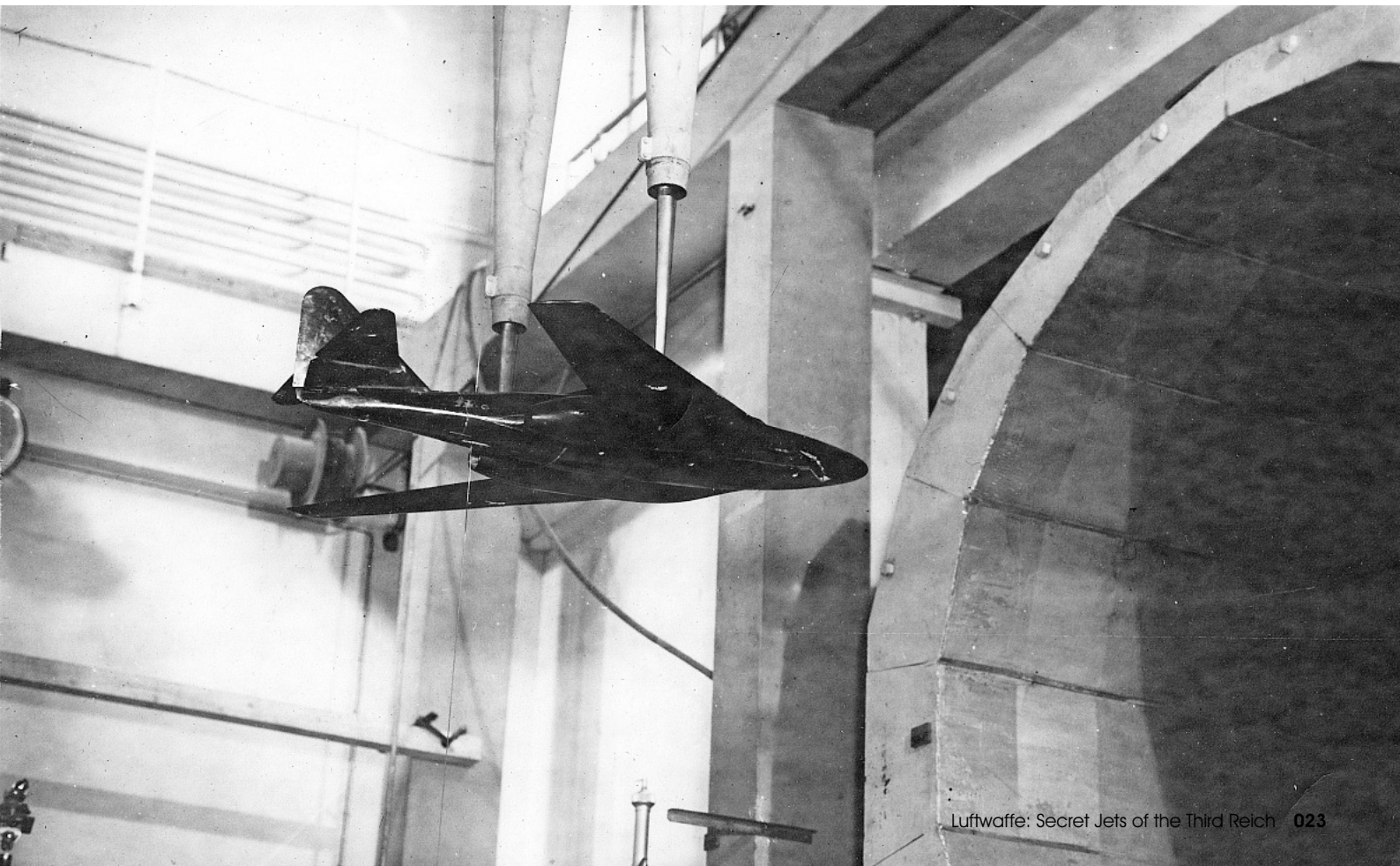
Serial production slowly commenced in April 1944 with the Me 262 being equipped as a fighter. Strenuous efforts were made, however, to work out how the aircraft could be made to carry a useful bomb load since Hitler was adamant that it should operate as a fast bomber during the Allied invasions he knew were imminent. When the invasion came, however, there were no 'fast bombers' harassing British and American forces as they struggled ashore.

The Me 262 did not enter combat in any meaningful numbers until towards the end of 1944. ●



ABOVE: Plans for the HG III wind tunnel model. Had the war progressed it is uncertain whether development of the Me 262 would have continued. The type was expensive to build and needed two complex engines – but it was proven to be effective in combat. GDC

BELOW: A wind tunnel model for, possibly, the next generation Me 262 – the HG III. GDC



From watcher to bomber

ABOVE: German reconnaissance specialist Oberstleutnant Theodor Rowehl's request for a jet-propelled camera platform in 1940 led directly to the creation of the Arado Ar 234.
Bundesarchiv Bild 146-2005-0009

Arado Ar 234

Better known for licence building the designs of others, Arado nevertheless had its own project office and in early 1940 was asked to design a jet-powered reconnaissance aircraft. Seemingly to everyone's surprise, the result was one of the two most successful jets of the war…

With privately owned and operated Heinkel and Messerschmitt competing fiercely to produce the Luftwaffe's first front line jet fighter, in the spring of 1940 the RLM decided that a less dynamic, more compliant company should be tasked with designing a jet reconnaissance machine.

The need for such an aircraft originated with the influential Oberstleutnant Theodor Rowehl of the Aufklärungsgruppe Oberbefehlshaber der Luftwaffe (Ob. d. L.) – the reconnaissance wing of the commander-in-chief of the Luftwaffe.

Since the early 1930s and under a variety of different names, Rowehl's unit had been secretly using specially prepared extreme high altitude aircraft, latterly the Ju 86R, to carry out photo reconnaissance of defensive positions in France, Poland and the Soviet Union.

When he became aware of the technology, Rowehl realised a jet-powered reconnaissance machine would be able to outrun any potential pursuer to get its photos home safely. He approached the RLM with a request for a jet with the range to overfly any part of Britain, up to and including Scapa Flow, and the ministry agreed to have one developed for him.

Arado, based at Neuendorf, west of Brandenburg, was the ideal company to do it. It had been nationalised as early as 1936 and received a substantial injection of capital in the process.

This enabled the firm to rapidly expand its production capacity – with which it was then required to build Messerschmitt Bf 109s, Heinkel He 111s and later Focke-Wulf Fw 190s and Junkers Ju 88s.

Arado did as it was told, largely without complaint, and was allowed to maintain its own design, development and aerodynamics staff as a result. By giving Arado alone the design brief for a jet bomber/reconnaissance aircraft, rather than issuing an official requirement, the RLM neatly sidestepped all the problems of having to deal with Heinkel, Messerschmitt or any of the other aviation firms that were already struggling with their own designs.

Arado technical director Walter Blume was not thrilled by the prospect of having to develop a low volume high-flying jet-powered reconnaissance aircraft but orders were orders. He handed the project to the company's 31-year-old head of aerodynamics Rüdiger Kosin and let him get on with it.

Kosin recalled: "There was no official requirement for the aeroplane with the usual accompanying design competition.

"Only Arado was entrusted with the task of establishing whether an aircraft with the necessary performance was feasible. The number of aeroplanes planned was 50. For this reason and his lack of confidence in the new form of propulsion, Blume showed little interest in the project.

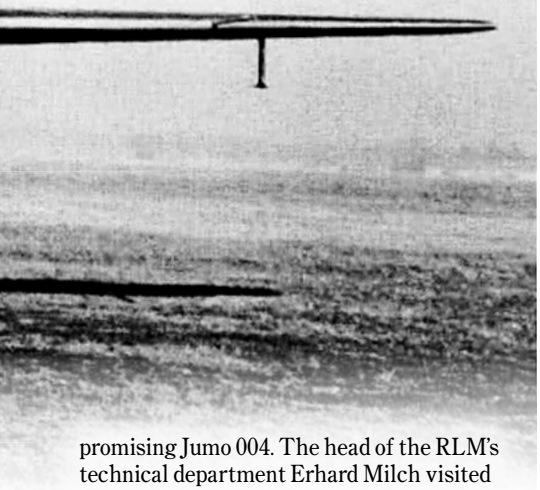
"Therefore we, the advanced design department, could work with little interference on a straightforward design."

The project was given the company designation E.370 and initial design work ranged across nine different layouts – some larger, some smaller, with different engine arrangements and wingspans. All featured a simple cigar-shaped fuselage with straight wings and cruciform tail.

It was decided to proceed with design E.370/IVa in October 1941. It was a single-seater that would be powered by a pair of BMW P.3302 engines (BMW 003), one under each wing, with a pair of Rb 50/30 or Rb 75/30 cameras positioned in the rear fuselage. There was to be a wooden skid rather than wheels as landing gear.

During three months of further design work, the E.370's fuselage was enlarged and its intended powerplant was switched to the more

LEFT: C-series development aircraft Arado Ar 234 V21 was powered by four engines grouped together in a pod of two under each wing. The Ar 234C was intended to fulfil a wide range of roles but arrived too late to enter service. via author



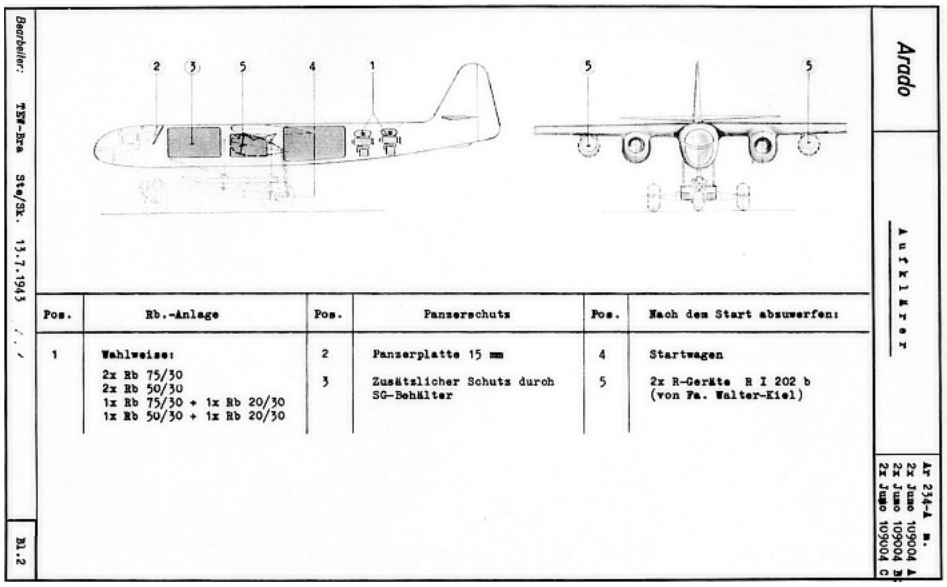
promising Jumo 004. The head of the RLM's technical department Erhard Milch visited Arado on February 4, 1942, and after viewing the E.370 drawings commissioned a full scale mock-up. At the same time, the RLM gave the project the official designation Ar 234.

In April 1942, the RLM commissioned six Ar 234 prototypes. These were to have metal, rather than wooden, skids and there was to be an outrigger beneath each engine for added protection during a hard skid landing.

For ease of taxiing on the ground and take-off, a simple three-wheeled parachute-equipped dolly was devised. This would remain attached to the aircraft until shortly after take-off, when it would be jettisoned and would float safely back to earth under its parachute. Attachment points for rocket-assisted take-off units were also added to the Ar 234's wings just outboard of its engines.

On December 28, 1942, with both Arado's straightforward designs and Jumo's 004 engine looking increasingly promising, the RLM increased its prototype order to 20. At around the same time, construction work began on the Ar 234 V1 prototype. It was finished early the following year but did not receive its first set of Jumo 004s until February 1943.

Even with these installed, the runway at Arado's factory was too short so only taxiing



ABOVE: This page from an Arado document details how the aircraft was to take-off on a trolley with assistance from a pair of underwing Walter rocket engines. via www.deutscheluftwaffe.de

trials could take place until early July when Ar 234 V1 was taken to bits and ferried to the better-equipped airfield at Rheine in the back of an Ar 232 transport aircraft. It arrived on July 18 and was swiftly reassembled in readiness for a week of ground trials aimed at ensuring the safety and stability of the take-off dolly.

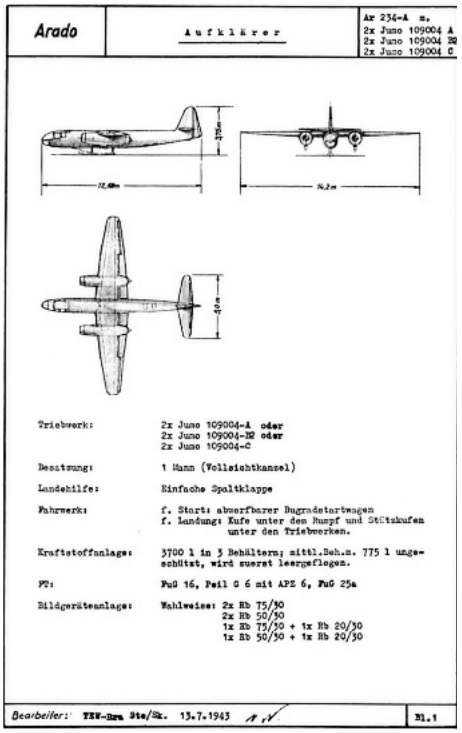
After some minor problems, including an engine fire, Ar 234 V1 made its first flight on July 30, 1943. It remained aloft for 14 minutes having taken off without rocket assistance. The dolly was released at 2000ft but the parachute failed to open properly and it was smashed to bits when it hit the ground.

A second flight followed on August 1, with the Ar 234 V1 reaching 404mph during 54 minutes of test manoeuvres. The dolly's parachute failed again and another dolly was destroyed.

For the third flight, on August 29, the dolly's parachute container was relocated and the dolly itself was jettisoned immediately after take-off. This worked, and the third dolly survived intact. Unfortunately, when coming in to land, test pilot Flugkapitän Horst Selle, overshot the airfield and the aircraft was wrecked during the subsequent hard landing.

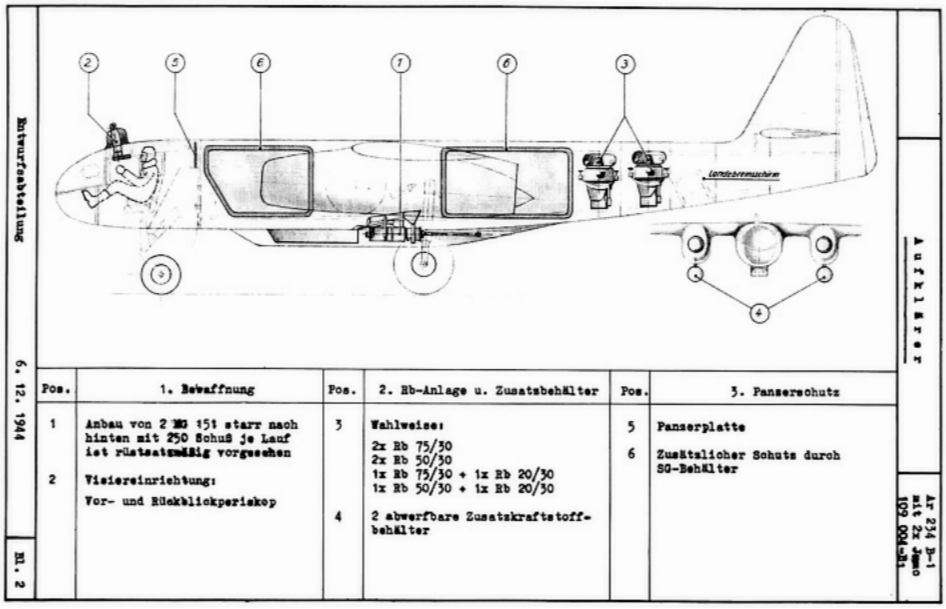
Within a matter of days, however, Ar 234 V2 was ready. Static tests on September 7 revealed that both of the Jumo 004s fitted had major faults and needed to be replaced. This done, the aircraft was flown to the airfield at Alt Lönnewitz in eastern Germany for further testing.

By now, the RLM had become interested in the potential of the Ar 234 as a bomber. Arado was asked to design a version that could



ABOVE: The Ar 234 was intended as a reconnaissance machine at the outset. This document dates from around two weeks before the first prototype made its first flight. via www.deutscheluftwaffe.de

BELOW: The Arado Ar 234 V1, TG+KB, WNr. 130001, with skid extended and sitting on its tricycle startwagen. via author



ABOVE: This document from December 1944 shows how the Ar 234 might have been fitted with a pair of rear-facing MG 151s for self defence. Various arrangements of weaponry were proposed. via www.deutscheluftwaffe.de

accommodate a bomb load but since the aircraft's narrow fuselage was almost entirely taken up with fuel tanks, the company's designers were forced to consider different ways of attaching a payload externally, with all the accompanying performance penalties from drag.

Furthermore, the experiments already conducted with the take-off dolly had persuaded the Ar 234's designers that the full production version would benefit from a fully retractable wheeled undercarriage and design work on this configuration quickly got under way. The skid version was designated Ar 234A, while the wheeled undercarriage type became Ar 234B.

Ar 234 V3 first flew on September 29, 1943. The ferry flight from Brandenburg to Alt Lönnewitz took just 21 minutes. During his fifth flight in Ar 234 V2, on October 1, Selle noticed that the aircraft had caught fire. He tried to save the aircraft, then to bail out, but it was no use – he was killed when the aircraft crashed and was destroyed.

On November 21 Ar 234 V3, the only remaining prototype, was taken apart, crated up and driven to Insterberg, East Prussia, on the backs of several lorries. It then formed part of a personal display of new technology for Adolf Hitler, alongside two Me 262s and a Me 163B. Even though the Arado machine wasn't flown, the Führer liked it so much he ordered the company to build 200 examples, a mix of Ar 234B-1 reconnaissance versions and Ar 234B-2 bombers, before the end of 1944.

Ar 234 V4 was finished on October 24, 1943, but did not fly until November 26 owing to engine problems. When it did fly, it took off with the assistance of underwing-mounted rockets.

The first flight of Ar 234 V5 was on December 22, 1943. This was fitted with Jumo 004B-0 engines which, while they produced the same thrust as Jumo 004As, weighed 220lb less. Coming in to land, test pilot Flugkapitän Johann Ubbo Janssen struggled to reduce the engines' throttle and had to make a very fast approach.

Touching down, the landing skids collapsed and the aircraft rolled from one wingtip to the other as it skittered across the concrete runway, causing damage on both sides. This was repaired by January 20, 1944, when the aircraft made its second flight – this time without incident.

While these tests were being carried out with Jumo 004-equipped Ar 234s, Arado had not forgotten about the BMW P.3302. It was still considered that a version of the aircraft powered by the P.3302 was a viable proposition. However, four of the lightweight but underpowered BMW engines would be needed, rather than just two Jumo 004s.

The Ar 234's wing could not be redesigned to accommodate the P.3302 so two options were considered. First, the BMW units could be bolted together in pods, each housing a pair of engines and then attached to the same points used to attach the single Jumo 004s. Alternatively, one BMW engine could be attached to each of the Jumo attachment points, then another BMW engine could be fitted to each of the outboard rocket attachment points.

The prototype with two double-engine pods was Ar 234 V8, and this flew for the first time on February 4, 1944, though further tests were called off because the engines proved extremely unreliable. The prototype with four separate BMW engines, Ar 234 V6, first flew on April 25, 1944, but had the same problems. These brief tests did, however, demonstrate that the two-pod arrangement was best.

On February 22, 1944, special snow skids were testing on Ar 234 V5 but these struck ruts during the landing run and collapsed. The cockpit hit the ground hard and the glazing was shattered.

AR 234 VARIANTS

The development of the Ar 234 continued right up to the end of the war – at which point several further versions were either planned or actually entering production.

Ar 234A – the first version of the Ar 234 was designed purely as a reconnaissance machine and had a skid undercarriage. All later Ar 234s had wheels. It was built only as a series of eight prototypes – V1-V8.

Ar 234B-0 – pre-production version with tricycle wheeled undercarriage, powered by a pair of Jumo 004 engines.

Ar 234B-1 – reconnaissance version with two Rb 50/30 or Rb 75/30 cameras in its rear fuselage. Created by converting aircraft originally built as Ar 234B-2s.

Ar 234B-2 – bomber version, capable of carrying a load of up to 1500kg (3307lb) externally. There was a bomb attachment point under each engine and another beneath the fuselage. 210 built but an unknown number of these were converted to B-1 configuration.

Ar 234B-2/N – night fighter version. Two Ar 234B-2s were converted to this configuration.

Ar 234C-1 – reconnaissance version but powered by four BMW 003s instead of two Jumo 004s. 14 Ar 234C types built but most were never fitted with engines and none entered service.

Ar 234C-2 – bomber version, but with four BMW 003s.

Ar 234C-3 – multi-purpose version with two 20mm MG 151/20 cannon fitted beneath its nose.

Ar 234C-3/N – planned night fighter version with two MG 151/20 cannon and two MK 108 cannon.

Ar 234C-4 – reconnaissance version but also armed with four MG 151/20s.

Ar 234C-5 – planned bomber version with two crew members in staggered side-by-side seating.

Ar 234C-6 – planned long-range reconnaissance version with two crew members.

Ar 234C-7 – planned night fighter version with two crew members and powered by two HeS 011 jet engines.

Ar 234C-8 – planned single-seat bomber with two MG 151/20s and powered by two Jumo 004D jet engines.

Ar 234D-1 – planned reconnaissance version with two crew members powered by two HeS 011s.

Ar 234D-2 – planned bomber version with two crew members powered by two HeS 011s.

Ar 234P-1 – planned night fighter with lengthened fuselage to accommodate intercept radar unit, two crew members, one MG 151/20 and one MK 108, and powered by four BMW 003As.

Ar 234P-2 – the same as P-1 but with cockpit redesigned to incorporate 13mm armour plating.

Ar 234P-3 – the same as P-1 but with two MG 151/20s and two MK 108s, and powered by two HeS 011s.

Ar 234P-4 – the same as P-3 but powered by two Jumo 004Ds.

Ar 234P-5 – the same as P-3 but with one MG 151/20 instead of two, and with a second pair of MK 108s in the fuselage fixed to fire upwards at an oblique angle.

Ar 234R – planned high-altitude reconnaissance version powered exclusively by a twin-chamber rocket engine in its tail.

Starting on February 24, 1944, Ar 234 V3 was used to test braking parachutes. These slowed it down rapidly enough to dramatically reduced the length of runway required for a landing.

The first Ar 234 to feature the new wheeled undercarriage, a tricycle arrangement, was V9 and this first flew on March 10, 1944. V10 first flew on April 2 and was used to test the B2A bomb sight. V11 was fitted with a pressurised cockpit and took to the air for the first time on May 5. The first pre-production Ar 234B-0 was completed in early June and first flew on June 8.

PROTOTYPES ON THE FRONT LINE

During the spring of 1944, as testing of the Ar 234 prototypes progressed, it became increasingly clear that the Allies were gearing up for an imminent invasion of occupied France.

With this in mind, reconnaissance pilot and Knight's Cross holder Hauptmann Cornelius Noell asked whether a pair of Ar 234s could be prepared and made available for active service over the Allies' landing beaches, wherever they proved to be. It was decided that they could and work to fit Ar 234 V5 with two Rb 50/30 cameras in its rear fuselage began.

The second machine was the long delayed and only just completed Ar 234 V7. This differed from the V5 only in that it was meant to have had the cameras fitted as it was being built. It flew for the first time on June 22, 1944 – more than two weeks after the D-Day invasion – and when Arado chief test pilot Walter Kröger brought it in to land the skid collapsed.

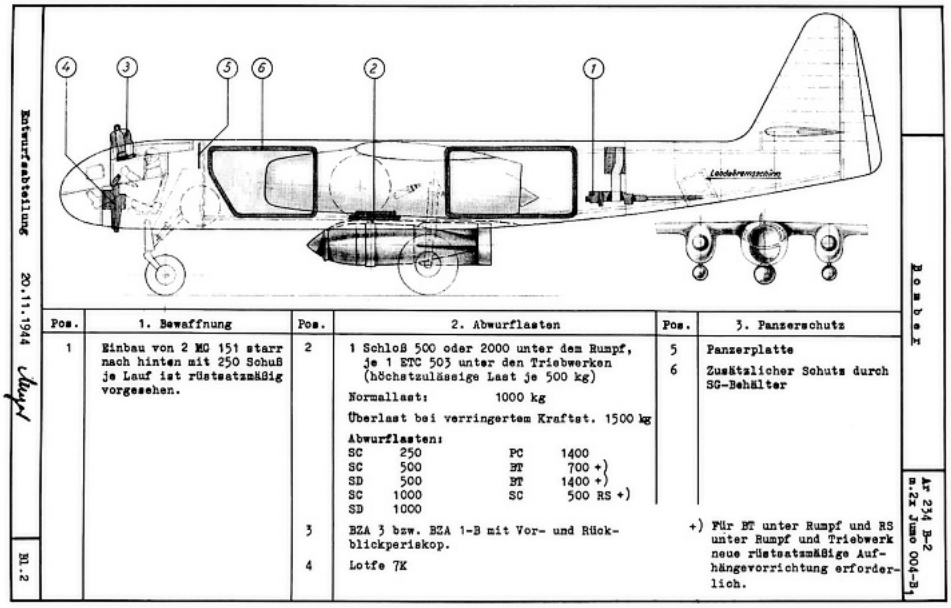
This only took four days to repair, however, and the aircraft was back in the air to test its photographic gear on June 26, 1944, with Oberleutnant Erich Sommer of the Luftwaffe's 1./Versuchsverband at the controls. Just over a month later, on August 2, Sommer flew Ar 234 V7 over the invasion beachhead – making the world's first operational reconnaissance flight in a jet aircraft. He flew V7 again on August 6, this time over Cherbourg.

On August 8, 1944, Oberleutnant Horst Götz, also of 1./Versuchsverband, flew Ar 234 V5 on an operational sortie over St Malo. Three days later, both Ar 234s were in action – with Sommer again flying over Cherbourg and Götz taking V5 over Armentieres.

This run of reconnaissance flights was short-lived however. On August 26, Sommer flew a mission over Paris and two days later had to transfer from his operational base at Juvincourt to Chievres in Belgium as the advancing Allies got too close for comfort.

Götz was meant to make the same transfer on the same day, but his machine was hit by flak near Brussels and his hydraulics were damaged. He flew to Brandenburg for repairs but found the airfield burning following an Allied air raid and diverted to Oranienburg where he was forced to make a belly landing. The cockpit glazing was smashed and a short while later a taxiing Fw 190 fighter crashed into it, causing extensive and irreparable damage.

Serial production of the Ar 234B-2, the first full production type, began in July 1944 – following the completion of the first 20 pre-production Ar 234B-0s. Ar 234B-1 reconnaissance versions were Ar 234B-2s retrofitted with camera equipment. ●



ABOVE: The standard Ar 234B-2 bomber arrangement but with a pair of MG 151s in the tail which, in active service, were never fitted. via www.deutscheluftwaffe.de

ABOVE: Landing with a skid was no mean feat, as demonstrated by Ar 234 V2. Once the skid had touched down, the aircraft would wobble from side to side alarmingly before coming to rest. via author

ABOVE: Boasting four separately podded and tremendously unreliable BMW 003 engines, the unfortunate Ar 234 V6 served only to demonstrate that the two-podded layout worked best for four engines. via author

ABOVE LEFT: Throughout the Ar 234's development it was fitted with BMW 003 engines – only for them to experience serious reliability problems. The Ar 234 V17 pictured here has the BMW 003's bulbous housings under its wings alongside its outboard rocket take-off engines. The canvas package at the front of the rocket engine was a parachute so that once it had been jettisoned it could float back down and be reused. ABOVE RIGHT: Similar to the production version Ar 234B, the V9 was the first airframe to have a fully retractable wheeled undercarriage. via author

ABOVE: The Arado Ar 234 V1 prototype takes to the air for its third flight, with the take-off trolley dropping away, having been slowed by its parachute. via author

Flawed genius

Alexander Lippisch and the Messerschmitt Me 163

Though it is often seen as a last minute weapon of desperation, the Me 163 Komet rocket-powered interceptor's origins predate the Third Reich itself. Experiments with gliders and rocket engines in the 1920s would eventually result in one of the most unusual and most feared fighters the world has ever seen.

The origin of rocket-powered aircraft in general and the Messerschmitt Me 163 in particular can be traced back to a conversation between four Germans in 1928.

After the First World War, the construction of aero engines was forbidden in Germany by the Treaty of Versailles so former wartime pilots took to building gliders that would allow them to fly again.

Veterans erected hangars on the Wasserkuppe, the highest peak in the Rhön Mountains, and from 1920 onwards aviators gravitated there to take part in gliding competitions. This led to significant advances in aerodynamics and aviation technology as efforts were made to extract the maximum possible performance from engineless aircraft.

Among this band of aviators were Fritz Stamer and Alexander Lippisch. Both men had flown during the war, Stamer as a pilot and Lippisch as an observer and map maker. Lippisch had worked for the Zeppelin company after the war and had become an accomplished designer of high performance gliders – including tailless designs that he worked on from 1921.

Stamer was the chief pilot and instructor of the Research Institute of the Rhön-Rossitten Gesellschaft (RRG), the world's first officially recognised glider school, and Lippisch was the director of its aeronautical technology department.

By 1928 both men were in their early 30s.

Later, in the 1930s, Stamer recalled an unusual meeting that took place on the Wasserkuppe: "One day, two gentlemen came to see Lippisch and myself. They explained that they had to have an aircraft of the tailless type for a very special purpose.

"The two gentlemen, who did not disclose their names, were evasive about the purpose for which they wanted the aircraft. When we objected and said that if we were to do anything with the tailless models we must know somewhat more, we then learnt that an engine with a very low weight but with as great a thrust as desired was to be installed in the aircraft and tested.

"But behind the engine there were to be no more structural elements at all. These statements seemed rather fantastic to us, and so we did not take the matter very seriously. Nevertheless, we decided to remain in touch, on account of such a machine.

"Several days later, an illustrated journal fell into our hands by chance, in which were printed illustrations of Fritz von Opel's rocket runs. Among the gentlemen photographed in front of the rocket-driven car we again found our visitors. They were Max Valier and Friedrich Sander. We now knew all about the mysterious engine.

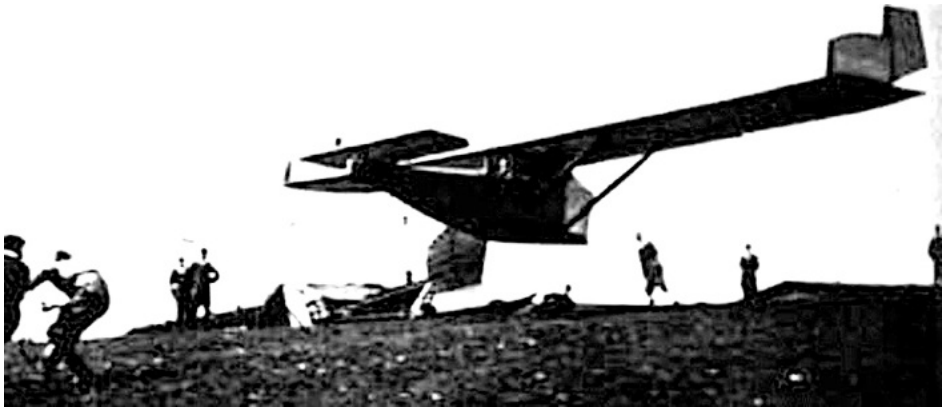
"We waited to see how things would turn out. We soon heard of it again. Tests were to be undertaken as soon as possible not only with models but also with manned aircraft."

Max Valier, another First World War veteran, had been working with Fritz von Opel, grandson of the founder of the Opel car company, on the rocket powered cars Stamer and Lippisch had read about. The first run of their RAK.1 car, powered by Sander rockets, on March 15, 1928, had proven somewhat disappointing with a speed of just 47mph. Two months later a new car, RAK.2, was ready. This vehicle sported a large pair of wings to provide extra downforce and had a cluster of 24 solid fuel rockets installed in its rear end. This was driven to a speed of 143mph on May 23.

Alexander Lippisch had decided to work with Max Valier on RAK.2 and on June 11 a Lippisch-designed glider fitted with a rocket engine, the Ente, or 'duck' was flown by Stamer. It was the first flight of a rocket-powered aircraft in history. The Ente, which had canards in front of the pilot, lacked the advanced features Lippisch was working on at the time – it had a straight rather than delta or swept wing.

ABOVE: The camouflaged full production version Messerschmitt Me 163B rocket-propelled interceptor. Designed in large part by glider specialist Alexander Lippisch it was the result of more than a decade of trial and error in aerodynamics. via author

ABOVE: Two of the four men with whom the story of the Me 163 begins – Fritz Stamer on the left and Alexander Lippisch on the right – pictured in the early 1930s. via author



ABOVE: Lippisch's tail-first 'Ente' glider is catapulted into the air on the Wasserkuppe. The Ente was the first manned aircraft ever to fly using rocket power. via author

ABOVE: The men who commissioned Lippisch to design the world's first rocket plane, Max Valier and Friedrich Sander, had already found fame with their Opel-back rocket car – the RAK.1. Lippisch worked with Valier on his followup, the RAK.2. via author

Stamer recalled: "The model tests with rockets burning for a short time showed us very high flying speeds with very high thrusts and with sometimes wild aerobatics.

"Then the flights with manned aircraft were to begin. The thrust of the rockets at our disposal had originally been too great, for we had calculated that for the 'Ente' a thrust of 12 to 15 kilos per rocket would be sufficient for the first tests. Two rockets were therefore drilled out in the nozzles. This resulted in the smaller thrust.

"These rockets consisted of steel cylinders about 50 to 60 centimetres long and approximately 15 centimetres in diameter, which contained almost four kilograms of blasting powder in a solidly compressed mass. The rockets had a powered phase of approximately 30 seconds each and were ignited electrically from the pilot's seat. The takeoff was to take place in the usual way by means of a launching cord. The rockets were to be ignited once the plane left the ground.

"There then followed a series of flights above the landing strip, lasting up to 80 seconds each. The 'Ente' could only accommodate two rockets which were to be ignited one after the other. After everything had taken place satisfactorily, a climbing flight was to be undertaken with rockets of a thrust of 20 kilos each.

"The take-off went without a hitch. The first rocket was burning and I had already become accustomed to the very loud hissing of the jet flame spurting from the nozzle, when about three seconds after ignition there was an ear-splitting explosion. I had learnt in the war that there was no longer any great danger if, after the explosion, one was still all in one piece.

"A hasty examination showed me that this was the fortunate position in which I appeared to be. But the entire aircraft was burning away merrily and, judging by the violence of the explosion, a few things contributing to its stability must have suffered some damage too. I was particularly concerned about the wing suspension.

"I decided not to force the burning bird down vertically, although in doing so the flames would be pushed back to the rear, but to let it glide down carefully so as not to break up in the air. I was further comforted by the thought that the second rocket was there behind me in the fire, likely to go off, one way or another, at any moment.

"Moreover, under my seat it was becoming first pleasantly, but then obtrusively warm. Fist-sized chunks of powder from the exploded rocket had come flying in all directions into the machine and had set fire to it. One such chunk was now appropriately situated under the thin plywood seat.

"At last I grounded the machine. I made the finest landing of my life, because I was very much averse to making a crash landing and thereby possibly coming into closer contact with the second rocket. This was likely to go off at any moment as it was, and things would be in a bad way if I happened to crash right onto it.

"No sooner had the machine stopped than I had already climbed out of it; I saw the ignition wire burning on the iron rocket casing and I tried to tear it away. But it was already too late. The second rocket ignited, but it fortunately

ABOVE: Alexander Lippisch pictured beside one of his early Storch-series aircraft. via author

burned out in the proper manner, despite the intense heating of the steel jacket. If it, too, had exploded, my prospects would certainly not have been very bright.

"Now I wriggled about in the wet grass in order to extinguish and cool my smouldering posterior. After the second rocket had burnt out I was then able to extinguish the burning ship with the helpers who had arrived in the meantime. My need to fly with powder rockets was temporarily satisfied.

"Apart from honourable burns, our 'Ente' did in fact have a breached rear spar element, so my cautious flying was justified. In the evening, we organized a big firework display in Gersfeld to celebrate the 'historic moment' as Opel put it."

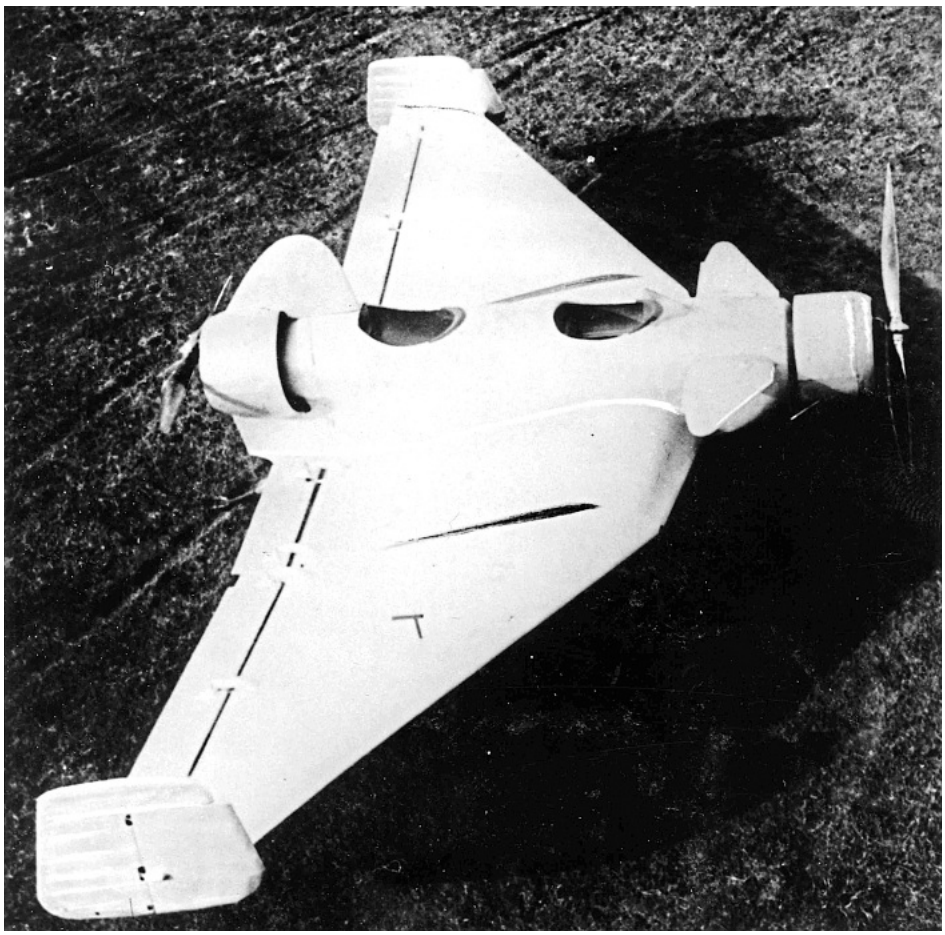
Opel commissioned another engineer to build him a second rocket aircraft but lost interest in rocketry after working on a rocket-powered railway car. He left Germany for good the following year.

Max Valier was killed in May 1930 when an alcohol fuelled rocket engine he was working on exploded.

Alexander Lippisch continued to develop his tailless aircraft, following the same process each time of producing meticulous drawings, conducting flight tests with models based on the drawings, then building a full scale aircraft. In 1929, the RRG built his Storch V design – his earlier Storch IV but with an engine and pusher propeller fitted. It first flew in September 1929 and towards the end of the year it was demonstrated for aviation pioneer Hauptmann Hermann Köhl, who was planning to fly across the Atlantic and needed an aircraft in which to do it.

The Storch V crash-landed but its performance in the air had impressed Köhl and he decided to award the RRG a contract to design and build him a new tailless aircraft.

Lippisch set to work and quickly draw up designs for a low-winged aircraft with swept leading edges and an entirely straight trailing edge – a delta wing shape. After model testing he decided that a high-winged design would work better but kept the wing shape and named the aircraft itself Delta. ▶



ABOVE: Once the first wave of Opel rocket pioneers had dispersed, Lippisch continued his work on delta-winged aircraft. His first Delta IV aircraft was built for Gerhard Fieseler, who called it the Fieseler F 3 Wespe. via author

With testing complete, construction of the aircraft began in 1930. When it was finally finished in June 1931 as a glider it was test flown on the Wasserkuppe before being successfully demonstrated at Templehof airport in Berlin, powered by a Bristol Cherub engine. Even though the aircraft handled well by all accounts, further financial backing beyond Köhl's initial investment was not at first forthcoming.

Lippisch continued on with the Delta series, however, building the Delta II which was similar to the Delta I but powered by an unreliable Ursinius 24hp engine. Then the RLM decided to award Lippisch's RRG a development contract based on the performance of the Delta I. Since the small RRG workshop took months to build each full scale machine, the RLM arranged the contract so that Focke-Wulf would construct the next in the series, the Delta III, at its Bremen factory.

In the meantime, the RRG had received another contract – this time from Gerhard Fieseler for a sports aircraft with foldable wings. Lippisch called the result the Delta IV; Fieseler called it the Fieseler F 3 Wespe. Three examples, featuring a foldable delta wing and canards, tandem seating and two British Pobjoy R engines – one in front and one pushing from the rear – were produced but the design was not a success.

The first aircraft was completed in May 1932 but was found, by Fieseler himself as his own company's chief test pilot, to be uncontrollable. Fieseler then pulled out of the project and left the Delta IV airframes with the RRG after picking up a hefty bill for the development work.

Lippisch had the RRG's workshops modify the Delta IV to become the Delta IVa, with the canards and rear engine removed. During an early test flight, the Delta IVa was wrecked during a near-collision with another aircraft but then rebuilt again with extensive modifications. This time its fuselage was constructed from welded steel, the front seat was removed, the trailing edge of the wings was swept back and the wingtip rudders were altered to point down and outwards.

With data gathered from the Delta IVb, Lippisch proceeded to the Delta IVc, this time with an enclosed cockpit, a reduced sweepback on its wings, a widened rear fuselage once again incorporating a second seat, winglets in front of the main wings and a small rudder attached to the rear of the fuselage.

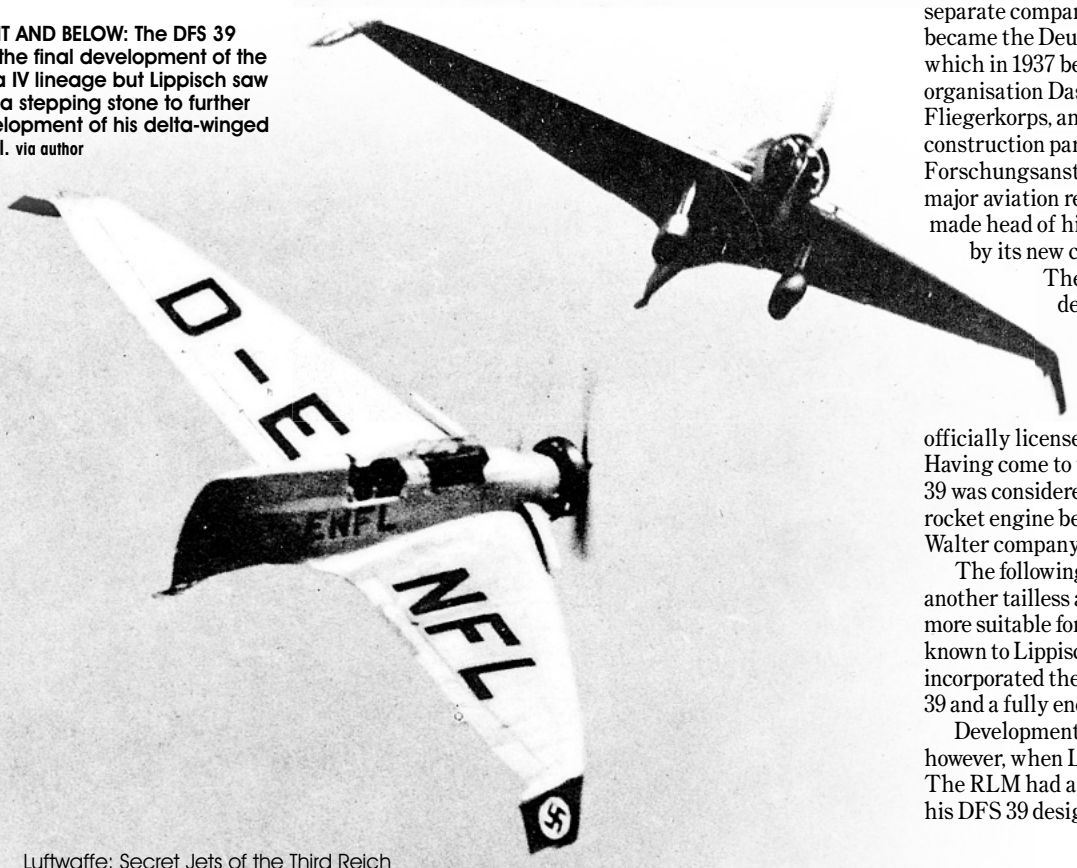
In 1933, the RRG was reorganised into two separate companies; the sports flying part became the Deutschen Luftsportverband, which in 1937 became the paramilitary Nazi organisation Das Nationalsozialistische Fliegerkorps, and the glider design and construction part became Die Deutsche Forschungsanstalt für Segelflug (DFS) – a major aviation research centre. Lippisch was made head of his own division within the DFS by its new chief executive Walter Georgii.

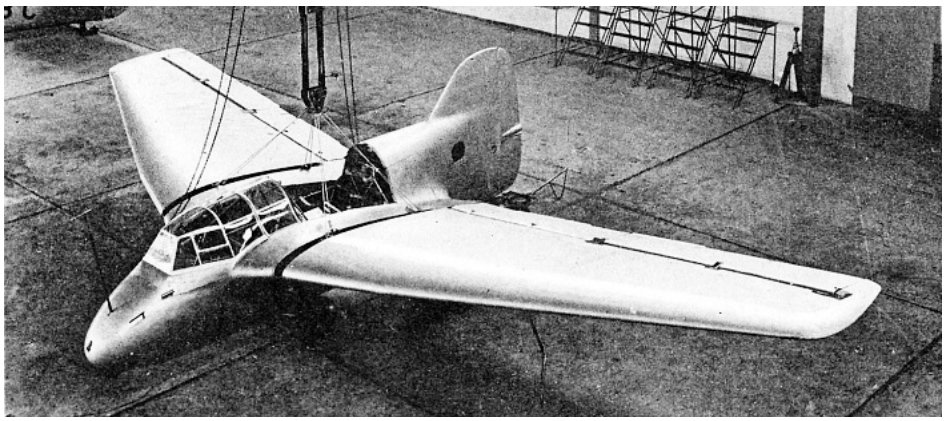
The Delta IVc received a new designation accordingly – DFS 39. Despite ongoing problems with directional stability, and after extensive testing at Rechlin, the aircraft was officially licensed as a sports aircraft in 1936. Having come to the notice of the RLM, the DFS 39 was considered as a test vehicle for a new rocket engine being developed by the Hellmuth Walter company.

The following year, 1937, Lippisch developed another tailless aircraft that appeared even more suitable for rocket propulsion – the DFS 40, known to Lippisch himself as the Delta V. This incorporated the same wing shape as the DFS 39 and a fully enclosed streamlined cockpit.

Development of the DFS 40 was cut short, however, when Lippisch left the DFS in 1939. The RLM had asked him to further develop his DFS 39 design with the Walter rocket

RIGHT AND BELOW: The DFS 39 was the final development of the Delta IV lineage but Lippisch saw it as a stepping stone to further development of his delta-winged ideal. via author





ABOVE AND LEFT: Almost the Me 163 – the DFS 194 was the direct forerunner of the famous rocket fighter. It was fitted with a rocket engine in the Messerschmitt workshops during 1939. GDC

engine. Lippisch had worked on a model of his proposed design, the DFS 194, but felt that the DFS was simply not up to the task of building it – even though construction of the full scale aircraft was well under way.

During a lecture entitled On the Development of Tailless Aircraft, given on November 6, 1942, Lippisch said: "The aerodynamic design of the new aircraft was explored in the years 1937-38. A model, measured in the large wind tunnel of the AVA Göttingen, revealed in every respect excellent results.

"The construction of such a high-speed aircraft could no longer take place in the workshops of the DFS, which were essentially geared towards the construction of gliders. Because now the time had come to make the tailless aircraft for the purpose it had been intended for all along.

"We decided therefore to proceed to industry and settled on Messerschmitt AG in Augsburg at the beginning of 1939. Here construction time was allotted for jet propulsion version of the Delta IV, the current pattern Me 163 A, which was designed and built by us.

"However, I must tell you that the entire aerodynamic design of the airframe and the basic design principles had already emerged in the DFS and this was thanks to the undisputed lasting merit of the head of DFS, Mr Georgii, who showed great understanding of the work in spite of all setbacks and difficulties during the developing years.

"This development work on tailless aircraft could never have been carried out within the industry, which has shown nothing but disinterest in it. Enthusiasm for the cause could only ever have been found in a research institute, such as the DFS."

Once Lippisch's team had been installed at Messerschmitt as Abteilung L or 'Department L', they immediately set about using the company's resources to convert the DFS 194 prototype to rocket power – it having originally been designed around a piston engine. The development of what would become the Me 163 was called Projekt X.

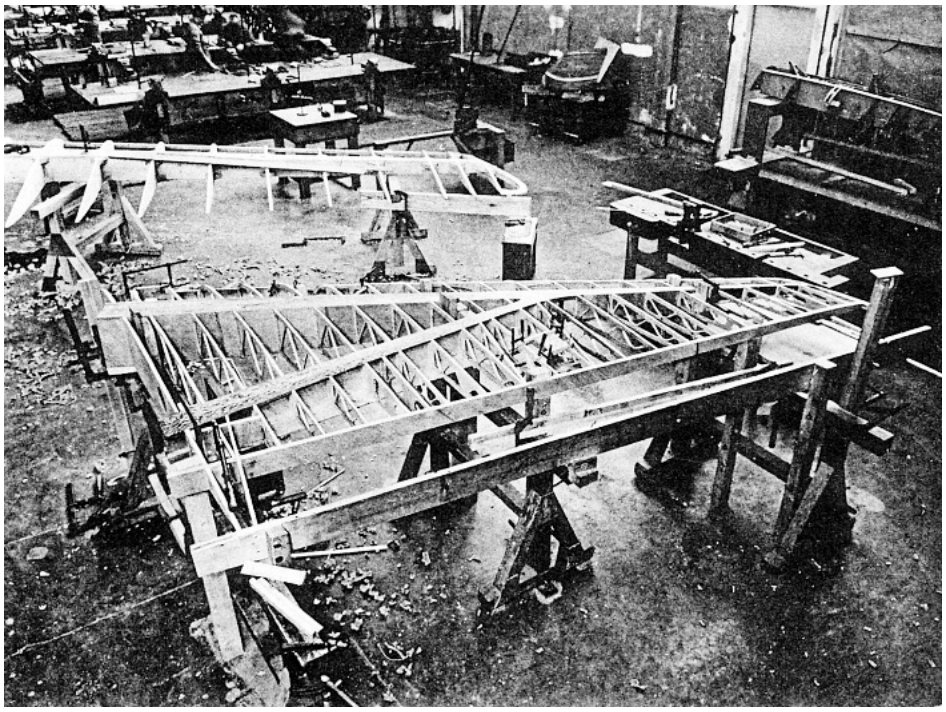
Thanks to Messerschmitt's experienced workforce and well-equipped facilities, conversion of the DFS 194 was largely completed within weeks. The engine was not ready, however, and ground tests of the new Walter HWK R.1-203 rocket motor did not begin at the secret Peenemunde test site until October 1939.

In the meantime, Lippisch rapidly turned out more than a dozen potential fighter aircraft designs based on his earlier research and the possibilities now offered by Messerschmitt. Abandoning his earlier Storch and Delta designations, he now started again with Lippisch P.01.

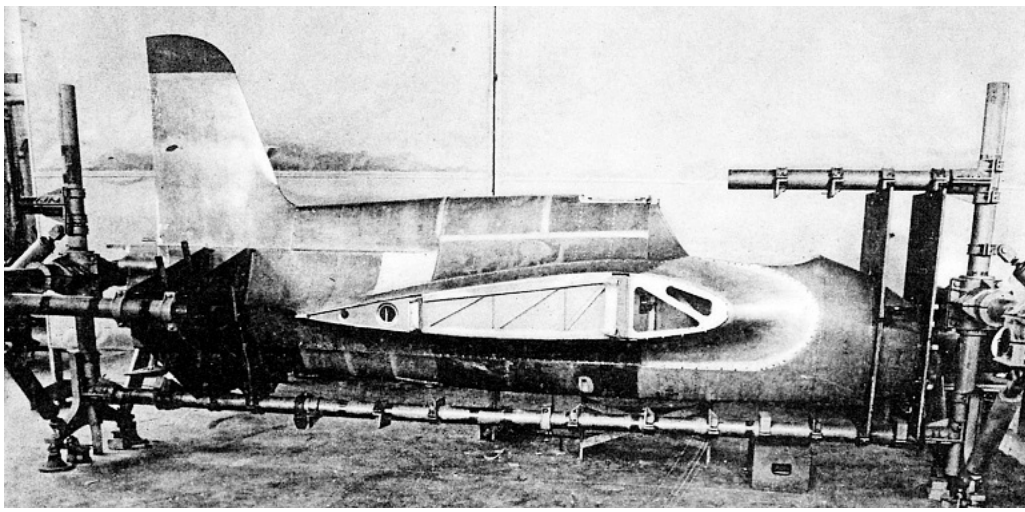
Drawn on April 13, 1939, design P.01-116, shows an unarmed turbojet-powered aircraft with short wings and a cockpit right at the front of its nose. Design P.01-111, dated October 20, 1939, was a turbojet fighter with a near-delta wing planform and MG 151 guns in its wing roots.

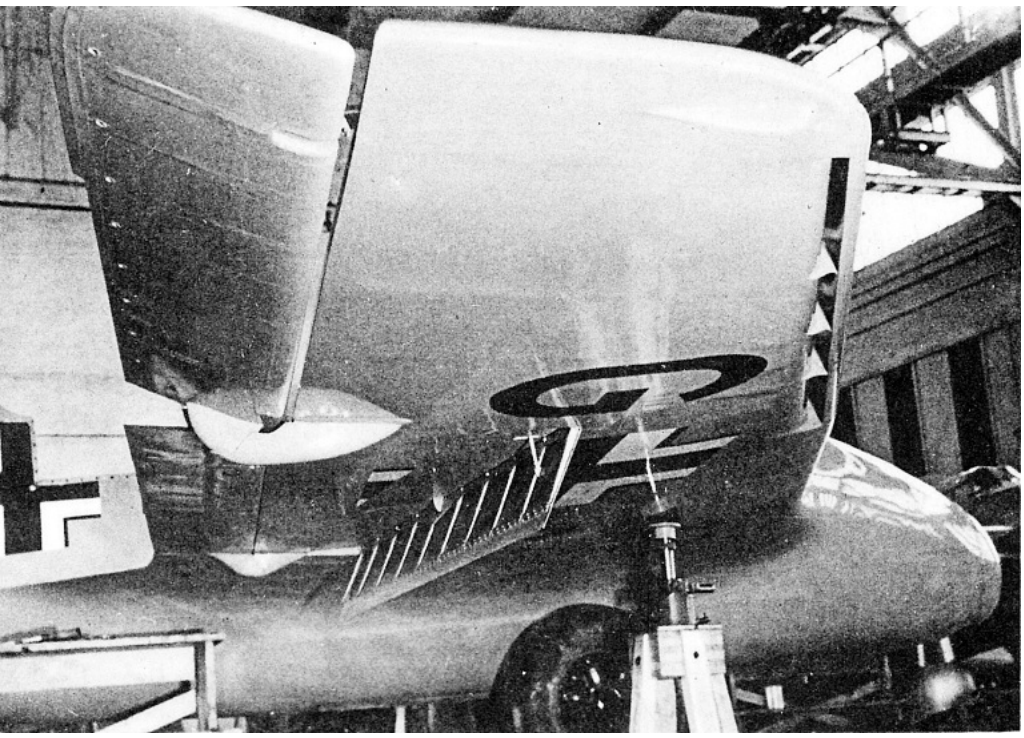
P.01-112 of January 31, 1940, had a turbojet and a system of funnelling air onto the upper surface of its wings. P.01-113 of July 17, 1940, had both a turbojet and a rocket engines within a tapering cigar-shaped fuselage with its wings set high. P.01-114 of July 19, 1940, was an unarmed experimental aircraft powered by a BMW 109-510 rocket engine.

This burst of drawing board activity probably resulted from inactivity on other fronts however. In his November 1942 lecture, ▶



ABOVE AND BELOW: A Me 163A fuselage and wings under construction at Messerschmitt in late 1940. GDC





ABOVE: A view from beneath the wing of the almost-completed Me 163A showing its complex design – leading edge slot, landing flaps and aerodynamically balanced control flaps. GDC

Lippisch said: "The outbreak of war put the production of the first new airframes initially almost completely on hold, so we could only begin with the test-flying in 1941.

"Meanwhile, however, we had the airframe of the DFS 194, originally built for Otto engines, converted for jet propulsion. With the new engine installed we were able to perform the first flight of this airframe in 1940.

"Up to this point the speeds we had achieved during flight were not higher than 250kph (155mph). With the DFS 194 with a jet drive, which yielded 300kg thrust, we sometimes reached a speed of 550kph (342mph), although the airframe was originally designed only for 300kph (186mph)."

While this work was ongoing, Lippisch clashed with both Willy Messerschmitt himself and the head of the Messerschmitt company's own project office, Woldemar Voigt.

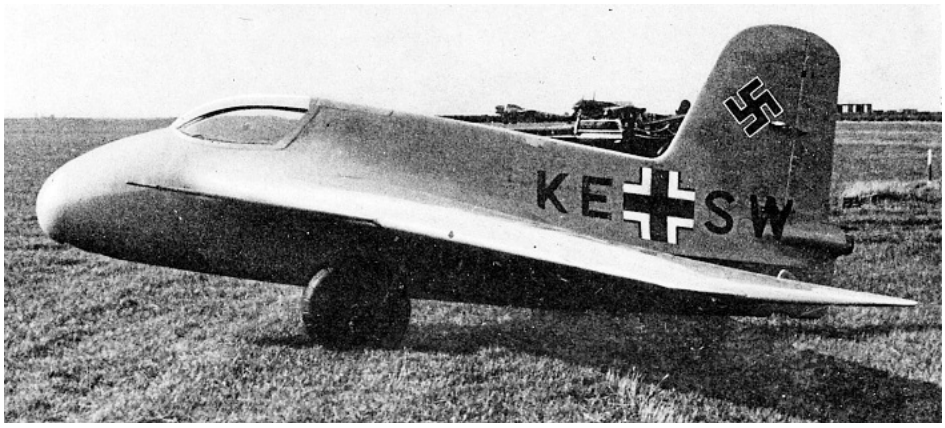
Some time during 1940 the design for the Me 163A was finalised and as the Battle of Britain wound down during the autumn, production capacity was found to begin work on building the first prototype. Me 163 V4, KE+SW, was completed during the winter of 1940 and made its first flight as a glider at Lechfeld on February 13, 1941. On June 12, 1941, Lippisch used the P.01-116 designation again for a mixed propulsion turbojet/rocket engine fighter with a chin intake and a month later Me 163 V4 (there was no V1, V2 or V3) was transported to Peenemunde for further testing.

At around the same time, on July 2, 1941, Lippisch designed the P.01-115, a fighter with two MK 103 cannon in the nose, powered by a BMW 003 turbojet mounted in the dorsal position with a rocket engine below it. He reused the P.01-116 project number on July 16 for another rocket-propelled interceptor design. It might seem odd that Lippisch used 'P.01-116' no fewer than three times during this short period for different designs but this is how the drawings are labelled in the book he wrote – Ein Dreieck Fliegt.

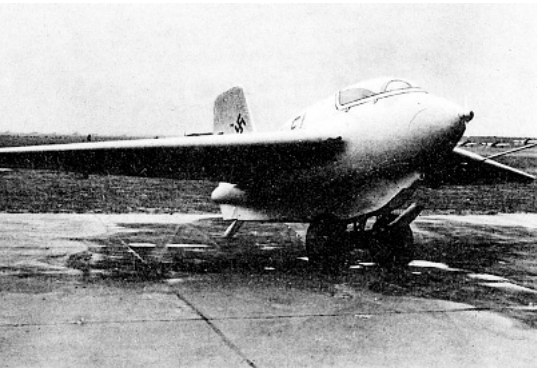
The sequence finally moved on with another rocket-powered tailless design, P.01-117, on July 22, 1941. For this addition to the Komet family, the pilot lay in a prone position.

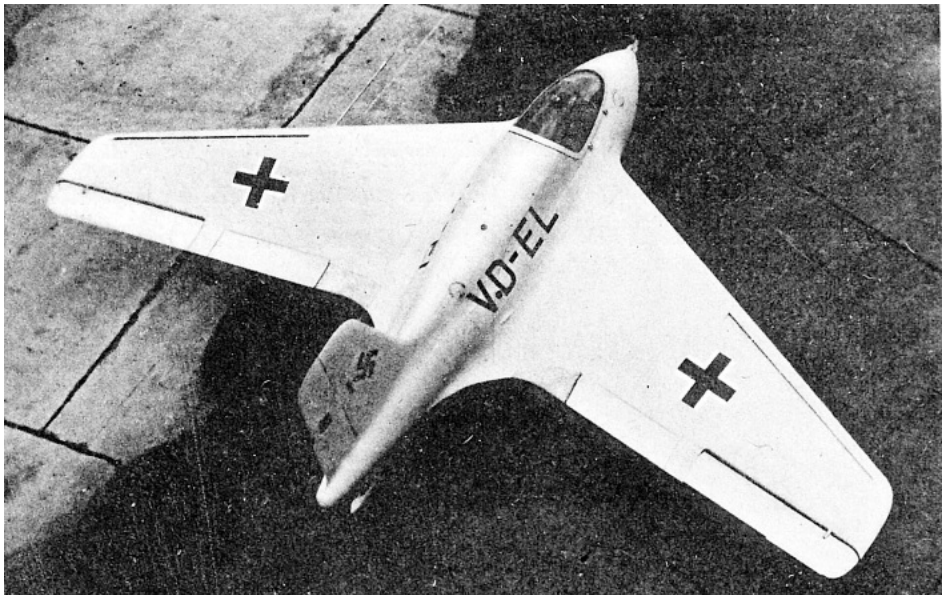
P.01-118 of August 2, 1941, featured an innovative pivoting seat which allowed the pilot to maintain a horizontal view even during a steep climb. In addition, two rocket motors were provided, one for the climb and another for level cruising. P.01-119 followed shortly afterwards with a heavy armament of four cannon and a pressure cabin.

Finally, on August 8, 1941, Me 163 V4 made its first flight under rocket power at Peenemunde.



ABOVE: The completed first Me 163A prototype – KE+SW. GDC





ABOVE AND RIGHT: Messerschmitt Me 163B prototype VD+EL. It has never been made entirely clear just how much of the Me 163B was designed, in detail, by Alexander Lippisch. He certainly regarded it as the last development of his work on the type but seems strangely reluctant to claim full credit for it – a reluctance he does not feel in claiming credit for the Me 163A. GDC

Lippisch recalled: "When we were able to begin jet-propelled flights with the new Me 163 during the summer of 1941, we realised the superiority of the shape of this tailless aircraft.

"With 750kg thrust, calculations showed that we should have been able to reach 850kph (528mph) near the ground, and 1000kph (621mph) at an altitude of 4000m. In fact, these speeds were flown after a short trial, and we found that we did not encounter stability problems due to the influence of compressibility until the limit speed of 1000kph."

In fact, Me 163 V4 was flown to a speed of 1004kph on October 1, 1941. On November 8, 1941, the second prototype, Me 163 V5, GG+EA, made its first gliding flight. Even as this work was being undertaken, however, Lippisch was refining his designs towards what would become the definitive rocket fighter – the Me 163B. A drawing of September 14, 1941, labelled Li 163, shows the distinctive features of the aircraft Allied bomber pilots would come to fear the most.

In all, 10 Me 163A aircraft were built by Messerschmitt at Augsburg – V4-V13.

Following the successful tests of the early Me 163A prototypes, the RLM placed an order for 70 Me 163Bs, based on Lippisch's revised designs. Work on building the first prototype was started on December 1, 1941.

Lippisch himself was less than entirely satisfied with the development of the Me 163B and said in his lecture simply: "The next step in this evolutionary series was the pattern that emerged as the Me 163B. Since it was constructed according to the same principles as Me 163A, there is no need to respond to this pattern in more detail here."

He was, by now, already working on the Me 163C which he viewed as the logical next step in the design's evolution. This was to feature a pressurised cabin, four MK 108 cannon, a bubble canopy to improve visibility, larger fuel tanks and a second rocket chamber for cruising at altitude.

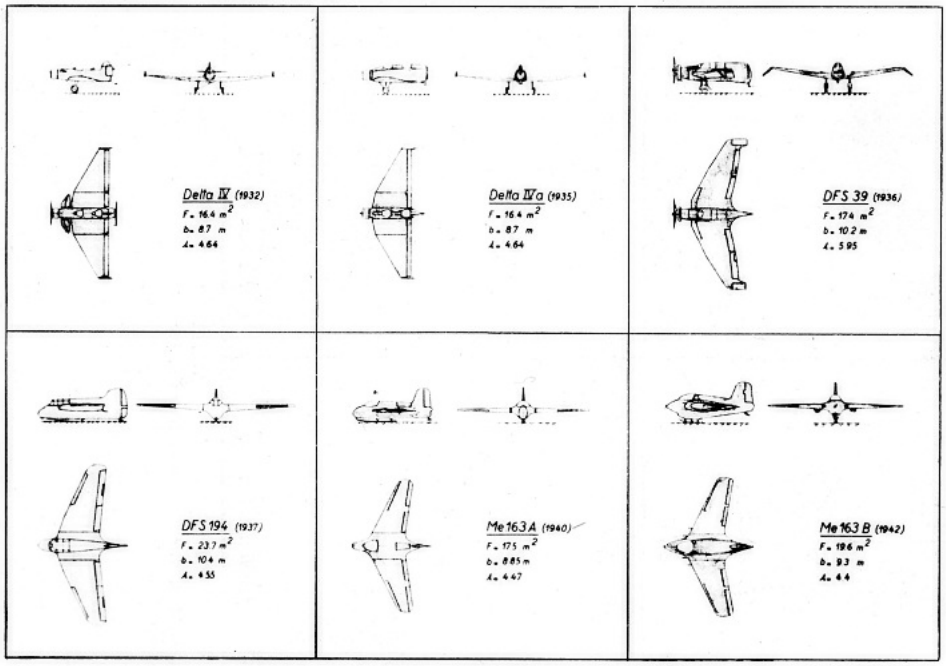
Meanwhile, the first Me 163B-0 prototype, V1, KE+SX, was completed by Messerschmitt at Augsburg in April 1942. The next four prototypes, V2-V5 were built by Messerschmitt at its Regensburg-Obertraubling facility and the V6 was constructed at Laupheim.

Me 163B-0 V1 first flew as a towed glider on May 26, 1942, while V2 and V3 were transported to Peenemunde for testing in July 1942. However, their new, more powerful, Walter 109-509A rocket engines were not ready and were not installed until June 1943. Me 163B-0 V1 reportedly made its first rocket-powered flight on June 24, 1943.

As testing progressed, it became clear that the Me 163's propulsion system had to be treated with great care. Having taken off on a jettisonable trolley, it was landed on a retractable skid. If this was incorrectly set up before landing, it would give the pilot a punishing hard landing which could result in spinal injuries.

It was also very easy to flip the Me 163 over onto its back during landing – potentially resulting in any small dregs of C-Stoff and T-Stoff fuels left in the aircraft's pipes, tanks or rocket chamber mixing. This would result in a violent explosion, on several occasions completely destroying the aircraft.

During the long period of down time following the Me 163B-0 V1's completion and first towed flight, Lippisch once again resumed his work on other projects. These included the P.05, another Me 163-like rocket fighter, the P.06 piston engine trainer, the P.07 pusher-engined fighter, the P.09 flying wing bomber series, the P.10 pusher-propeller dive bomber and the earliest iterations of the P.11 flying wing aircraft.



ABOVE: A timeline of Lippisch project development reproduced directly from a 1942 pamphlet on the subject compiled by Lippisch's associates. GDC

The level of frustration and antagonism that existed between Alexander Lippisch and the Messerschmitt company gradually came to a head however, and he left the company in April 1943 to join the Luftfahrtforschungsanstalt Wien (LFW) – Vienna's Aeronautical Research Institute – where he continued his work.

Conversion training for the Me 163B's future pilots got under way in September 1943, initially using a variety of existing gliders and then, from November 22, 1943, the various surviving Me 163A prototypes.

While construction of the first two dozen Me 163B prototypes was undertaken by Messerschmitt, in late 1943 the work was handed over to Klemm Technik in Stuttgart-Böblingen, which had previous experience of installing the rocket engines in some of the Messerschmitt-built prototypes.

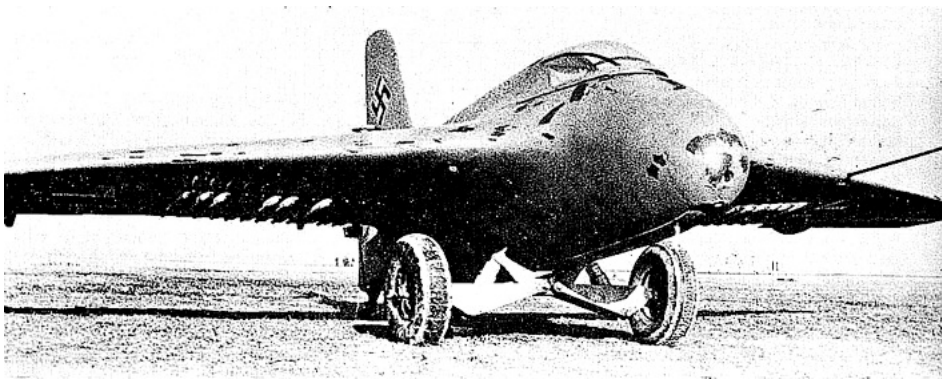
Unfortunately, completed Klemm-built Me 163Bs were found to suffer from markedly inferior build quality when compared with the Messerschmitt-made examples. After just 51 Klemm Me 163Bs had been constructed, production was handed over to a third company – Junkers – which managed to construct 299 before the end of the war.

Junkers initially worked in partnership with Klemm before taking over all responsibility for the type on September 1, 1944.

The first fully armed Me 163B-0, V14, was delivered to the first Me 163 test squadron in January 1944. The Luftwaffe received its first batch of operation Me 163B-1s in June 1944 and operations commenced in July 1944.

The Me 163 was extremely fast and handled well but its MK 108 guns had an extremely low rate of fire, which made it almost impossible for an Me 163 pilot to hit his piston-engined targets, usually American bombers, before he had already flown past them. The horrendously volatile nature of the fuels required by the aircraft's rocket engine also made it a dangerous and unpredictable machine to fly.

It was, in most respects, a failure. Yet it inspired many German aircraft designers to believe that, with a few changes, the basic principle of a rocket-powered interceptor could become an ideal solution to the problem of the huge waves of American bombers that were, by 1944, devastating German infrastructure on an almost daily basis. ●



ABOVE: Just 10 Me 163As were built and although most were destroyed in accidents, at least one is believed to have been used as a platform to test new air-to-air weaponry, such as this Me 163A fitted with underwing R4M rockets. via author

Rocket trouble

Verschleissflugzeug (spring 1944)

When RAF and USAAF bombers killed more than 42,000 civilians in Hamburg during July 1943, it abruptly became clear that Germany needed a way of destroying those aircraft. Surface-to-air missiles were being developed but were still years away from readiness, so a new sort of manned interceptor was needed…

ABOVE: The prototype Me 262C-2b, Me 262A-1a WNr. 170074 is ground-tested in spectacular fashion with BMW 003TLR turbojet/rocket engines. For months, fitting the Me 262 with additional rocket propulsion was deemed the best solution to Germany's problems in finding a suitable target defence interceptor. via author

With the first production versions of the Me 163B being readied for active service and with pilots being trained to fly them into combat, it was obvious from all accounts that the type had some serious flaws.

Unlike the Luftwaffe's first turbojet fighter, no competition or formal requirement had led to the creation of the Me 163 – just one man's singular vision and years of experimental work.

The type was destined to enter service as an interceptor, yet it had not been specifically designed for that purpose; rather, that was simply the mission that best fit its unique capabilities and its unique limitations.

By the beginning of 1944, effective interceptors were needed as never before. The USAAF's Eighth Air Force was causing severe disruption to German industry and infrastructure during the day, while the RAF was wrecking strategically important sites at night.

The first priority was to tackle the Americans and it was generally accepted that the Me 163B, though it embodied potentially game-changing technological advances, was an interim solution at best. Therefore, during the spring of 1944 an official RLM requirement was issued for a Verschleissflugzeug. A number of different interpretations have been given for this odd name, which translates literally as 'wear aircraft'. In context, however, verschleiss may have meant 'attrition', 'disposable', 'consumable' or 'throwaway'.

The precise details of exactly what was needed to meet the requirement are unknown. Similarly, while it has been suggested that the first presentation of tenders was made in August 1944, it seems that no clear winner emerged.

According to the British report German Aircraft: New and Projected Types, discussing minutes of an EHK meeting on November 21-22, 1944, under the heading 'target defence aircraft': "The importance of target defence was emphasised and consideration was narrowed down to the 8-248 (8-263), a development of the Me 163B; the Heinkel 'Julia'; Bachem 'Natter'; and the Me 262 interceptor with supplementary rocket propulsion.

"It was decided that since these developments were in an advanced state it was not expedient to abandon any of them. A proposal by the Special Commission for Jet Aircraft and Special Aircraft to defer or reject the 8-263 in favour of the He 162 was opposed on the ground that further development and series production of the 263 could be based on the work already undertaken in connection with the 163.

"The four types of target defence aircraft already enumerated were to be developed in the following priority: 1. Me 262 with supplementary rocket propulsion. 2. Heinkel 'Julia'. 3. 8-248. 4. Bachem 'Natter'.

"The development of the BMW rocket 109.708, using nitric acid, was to proceed on a high priority as this unit was intended for the three last-named developments."

In the same British report are minutes from

a second meeting held in Berlin, this time on December 22, 1944, when the same projects are discussed again: "Reference was made to the inadequate endurance of the Me 163B, and it was further stated that the Heinkel 'Julia' and Bachem 'Natter' projects did not hold promise.

"It was concluded that the development of the 263 should be expedited by all means and that the tests of the Me 262 with supplementary rocket propulsion should be pursued as with good results this aircraft might render all other target-defence interceptors superfluous.

"The development of 'Julia' was to be discontinued because of its inadequate endurance. Work on 'Walli' would also be suspended and resumption of development would be dependent upon results obtained with the Me 163, 263 and 262 (N.B. 'Walli' is the Junkers project EF.127).

"Although the 'Natter' project was opposed on technical and tactical grounds the completion of development was agreed to because the initial firing tests were due soon to take place. All preparations for series production, however, were to be discontinued."

Another British report, A.I.2 (G) No. 2347, on a diagram headed "German Target Defence Aircraft" details another design not mentioned at either meeting – Messerschmitt's P.1104. It is possible that this design was produced to the original requirement but rejected early on.

It seems likely that for the first round, and with production and development of the Me 163B having already been handed over to Junkers, Messerschmitt's only entry was the P.1104. This would make the August Verschleissflugzeug competition entries as follows: Messerschmitt P.1104, Heinkel P.1077 'Julia' and Bachem BP 20 Natter (drawings dated within August 1944 are known to exist for the latter two, the earliest known P.1104 drawing being dated in September 1944), none of them being approved, at that time, for prototype production.

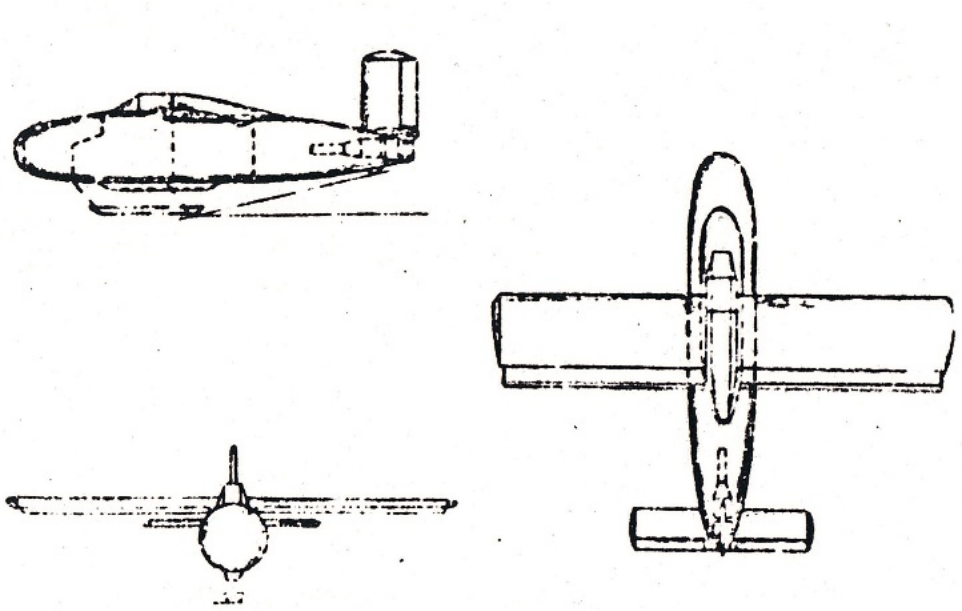
By November, the P.1104 had been rejected and in its place were two other Messerschmitt projects – the Me 262 with rocket propulsion and the Me 263 or '8-263', formerly known as the Junkers Ju 248. Finally, between the November and December meetings, and presumably because its Ju 248 design had now been redesignated as a Messerschmitt project, Junkers entered a version of its EF.126 pulse jet design, the rocket-powered EF.127 'Walli', only to see it very quickly rejected in favour of Messerschmitt's proposals.

MESSERSCHMITT P.1104

German Aircraft: New and Projected Types describes the P.1104 only briefly: "It was of very small size and powered by 1 x HWK 109-509 rocket. Take-off was to be horizontal and the landing to be made on skids. Armament comprised 1 x MK 108 (100 rounds)." Its range at altitude was to be 54 miles.

Despite the Messerschmitt company having already designed and built the Me 163 interceptor, the design of the P.1104 owed more to the V-1's wings, straight-edged and unswept, and the Me 328's fuselage – short and stubby.

It has been suggested that the P.1104 might have been designed to be towed aloft behind a Messerschmitt Bf 109G or Me 262, that different versions were intended as 'rammers' or explosives carriers. Little is known for certain however, other than that the project did exist and was intended at some stage to be a competitor in the contest to find an effective target defence aircraft.



ABOVE: Messerschmitt's P.1104 was a small rocket-propelled fighter design which, if it was an entry for the Verschleissflugzeug competition at all, was knocked out early on. TNA

HEINKEL P.1077 'JULIA'

At one time presumably the front runner in the competition, since the Bachem Natter of August 1944 was little more than an underdeveloped sketch from a small company with no form in designing fighter aircraft, and the Messerschmitt P.1104 was decidedly basic and uninspiring, Heinkel's P.1077 'Julia' was a radical advanced design.

The pilot lay prone in the aircraft's nose and on either side of the fuselage was a cannon, initially of unspecified type but later an MK 108. As with the P.1104, the engine was to be the Walter HWK 509. Take-off would have been accomplished horizontally, presumably on a trolley, with the aid of four solid fuel booster rockets, each providing 2640lb of thrust for 10 seconds, subjecting the pilot to 2.05G of acceleration, and allowing the aircraft to leave the ground after just 1140ft of travel.

An altitude of 16,500ft was to be achieved in just 31 seconds, with 49,000ft achievable in just 72 seconds. Endurance, however, was just 3.1 minutes at 33,000ft and at 560mph.

A retractable skid, similar to that of the Me 163, was to be the only landing gear provided.

By November 1944, the 'Julia' design had evolved, with the Walter HWK 509A being switched for a twin-chamber HWK 509B – the first chamber providing thrust for climbing while the second provided power for cruising and manoeuvring at high altitude. The twin cannon had been moved further forwards and were now positioned on either side of the pilot, and the positioning of the take-off rocket boosters was altered to provide more concentrated thrust.

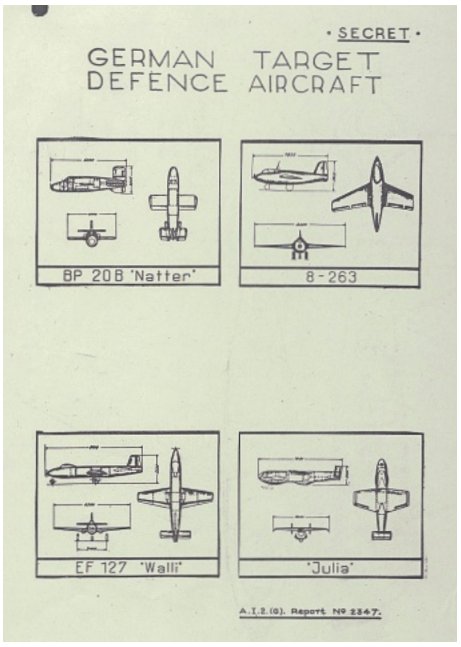
All of this put 'Julia' in second place behind a rocket-boosted Me 262. By December, however, the figures had become stacked against the Heinkel machine. Its extremely limited endurance meant that unless it could be launched directly into the path of oncoming waves of enemy aircraft it would be unable to reach them before running out of fuel.

The Me 262 and the Me 263 offered more time in the air and therefore 'Julia' was terminated.

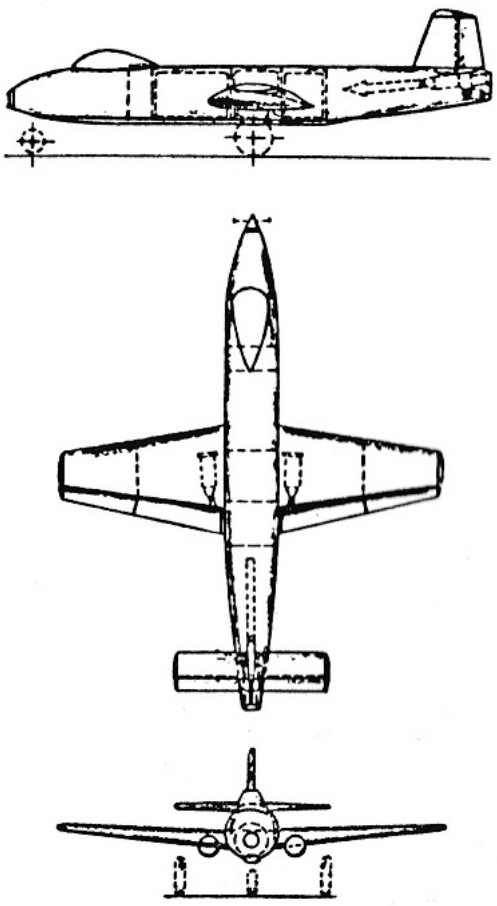
JUNKERS EF.127 'WALLI'

Put forward at the last minute, the design of Junkers' EF.127 'Walli' was derived in large part from the company's earlier proposed pulse jet-powered EF.126 project, detailed later on in this publication.

It differed from Heinkel's first 'Julia' design in having the pilot seated upright but in many other respects was very similar. 'Walli' was to be powered by a single twin-chamber HWK 109-509C rocket engine, armament was a pair ▶



ABOVE: This page from British A.I.2 (G) report No. 2347, reused as part of Foreign Aircraft Bulletin No. 26 of July 1945, shows at least some of the competitors for the contest. An earlier version of this same drawing showed a picture of the Me 163B to the top left, the 8-263 was top right, the Natter was middle left, 'Julia' was middle right, 'Walli' was bottom left and the Me 1104 was bottom right. Why the Me 163B and P.1104 were removed is unknown.



ABOVE: Heavy and underpowered, Junkers' EF.127 'Walli' looked like a true fighter, rather than a manned missile. Despite appearances, however, it was unable to carry sufficient extra fuel to increase its time in the air much compared to its competitors. And it was far slower. TNA

of MK 108 cannon and take-off involved a horizontal run of 1125ft – slightly shorter than that of 'Julia'. Only two solid fuel rockets were to be used for take-off and the design offered an endurance of 9.6 minutes, but at 16,400ft and a speed of 435mph.

It is little wonder that the EHK in its December 22 meeting, its first opportunity to assess Junkers' 'Walli', ordered that work on it be stopped and that it be pushed to the back of the development queue, behind the various Messerschmitt interceptor projects.

MESSERSCHMITT ME 263 (JUNKERS JU 248)

Since the later summer of 1944, Junkers had begun production of the Messerschmitt Me 163B after the previous contractor, Klemm, demonstrated that it was incapable of mass producing such an advanced machine.

Junkers became solely responsible for Me 163B production on September 1, 1944. Since the beginning of its involvement, however, Junkers had realised what a difficult machine it was to build and had begun looking at ways to improve it.

The company's designers very quickly came up with a new design based on the Me 163B, rather than on the evolution proposed by the aircraft's designer Alexander Lippisch, the Me 163C. This had a long slimmed-down fuselage that would be constructed in three main sections to speed up production – a pressure cabin with bubble canopy section, which would be riveted onto the main fuselage section, and finally a detachable tail section for easy engine access.

The main fuselage incorporated a fully retractable tricycle undercarriage while the fin, rudder and wings were almost entirely standard Me 163 components. In all only 60-70% of the aircraft was new.

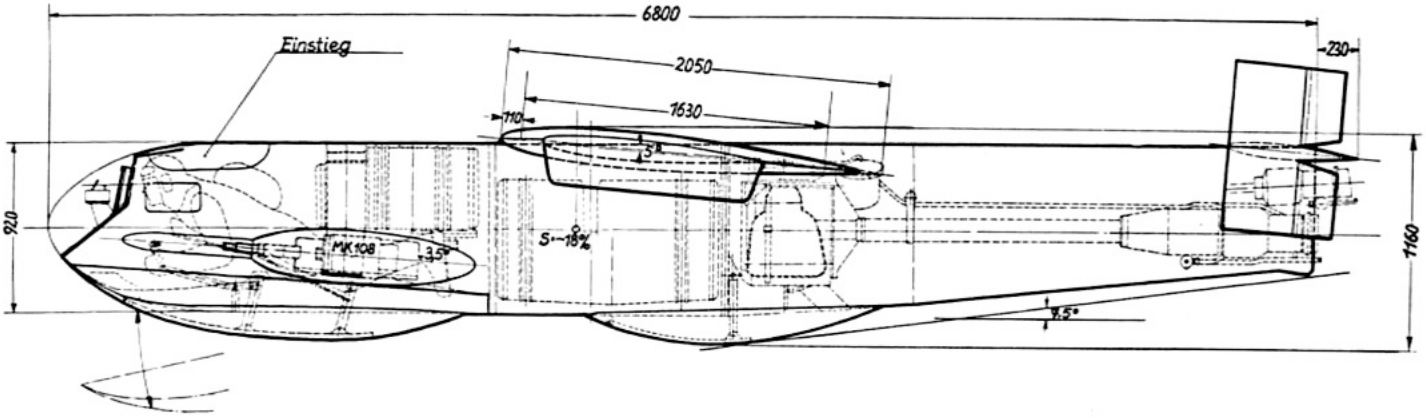
The type was rapidly given an RLM type number, Ju 248, and a full proposal was submitted on October 11, 1944, which compared its qualities with those of Messerschmitt's proposed Me 163C. The following day, the RLM held a meeting to discuss it.

At this meeting, Junkers chief engineer Professor Heinrich Hertel told officials that the Ju 248 would benefit from a more advanced version of the HWK 509 with twin-combustion chambers and more thrust. This would mean take-off would be just as quick as that of the Me 163B but changes to the aircraft's centre of gravity would make its control surfaces more effective, allowing a lower landing speed – of just 90mph compared to the Me 163B's worrying 120mph.

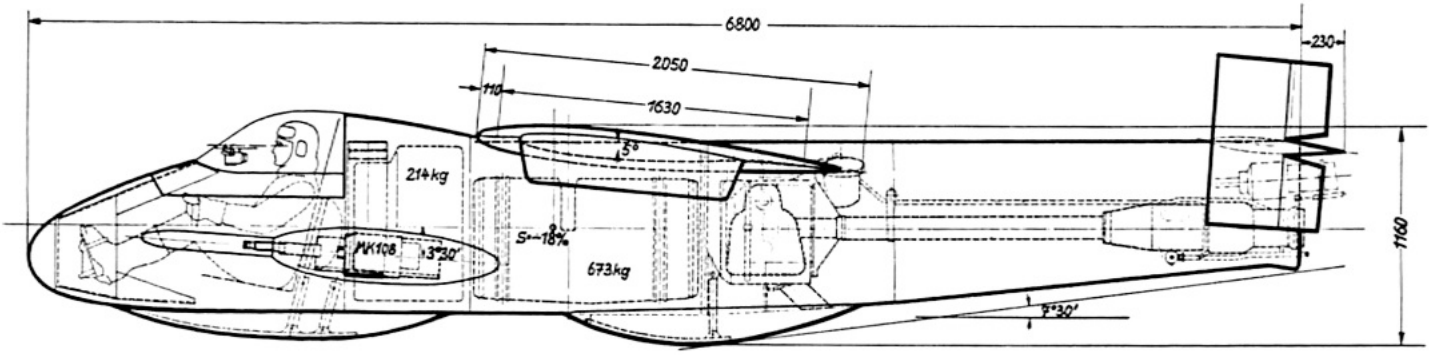
Hertel further promised that an interim prototype, the Me 163D V1, would be ready for testing by the start of December 1944 and the first prototype Ju 248 would be ready by Christmas. Eight days later, on October 21, 1944, Junkers was given a development contract to do exactly as Hertel had promised.

Efforts were made to modify two Me 163Bs to Me 163D standard – with fuselages lengthened by the insertion of two tubular sections, one just aft of the wing attachment points and one just in front of them. They also had non-retractable tricycle undercarriages. One of the two Me 163Ds was damaged before it could be completed but the other, Me 163B V18, made its first flight as a glider shortly before January 4, 1945.

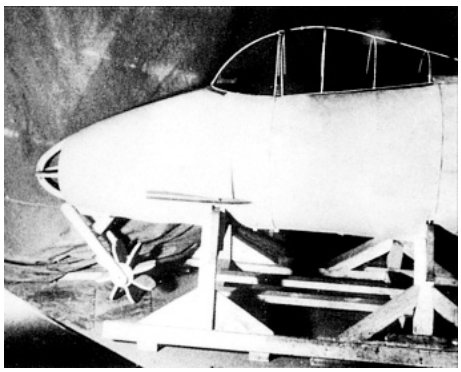
In the meantime, although the EHK's November meeting had placed the Ju 248 behind Heinkel's 'Julia', the December meeting had seen it triumph over all competition. The only issue was the new type's name. Willy Messerschmitt had protested at the idea of Junkers modifying one of his company's designs and giving it a new Junkers name.



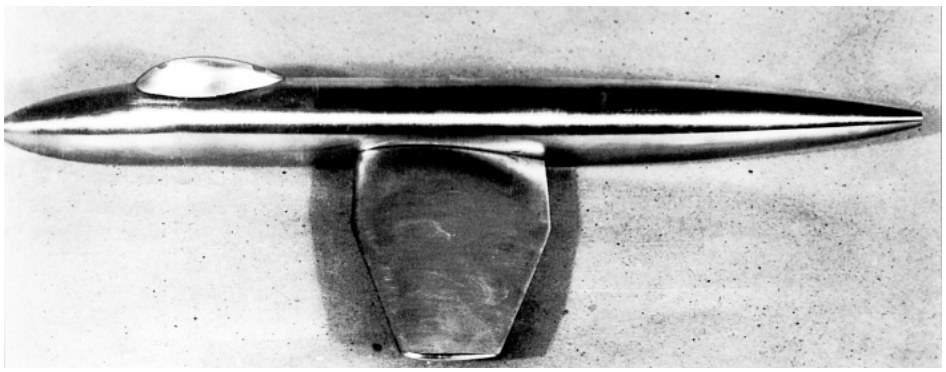
ABOVE: A side view of Heinkel's initially well-regarded P.1077 'Julia' rocket-powered interceptor design. via author



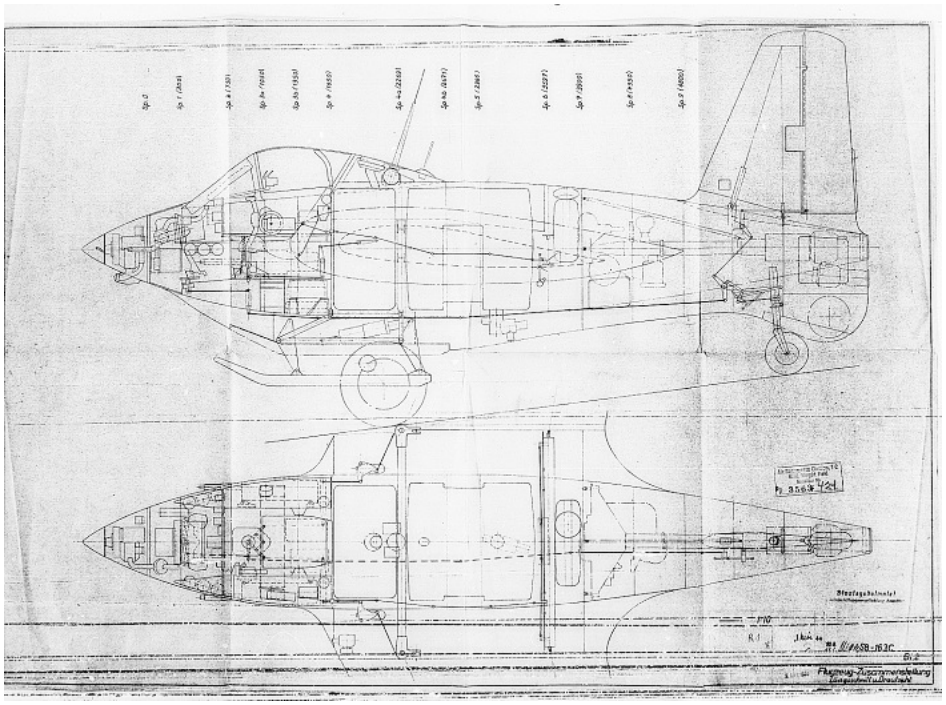
ABOVE: An alternative cockpit arrangement of the P.1077 was apparently known as the 'Julia II'. This drawing is believed to come from a report prepared for the Americans in 1945 following the capture of Heinkel's design team. via author



ABOVE: A key selling point of the EF.127 was its fighter-like design. Unfortunately, this was also its downfall. Nevertheless, Junkers felt sufficiently confident at one point to have a mock-up constructed. via author



ABOVE: Like every other Junkers design, the EF.127 was tested in the company's wind tunnels. via author



ABOVE: Alexander Lippisch's proposed development of the Me 163B – the Me 163C. In fact, it shared very few components with its predecessor and would have been even more complicated to build. via Scott Lowther

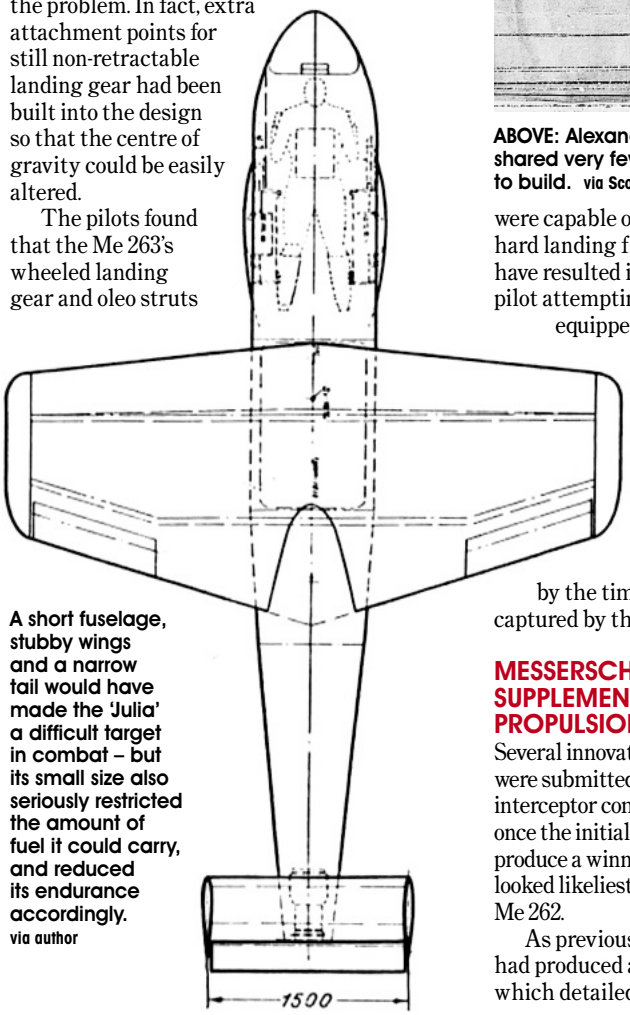
Therefore, by December the Ju 248 had become the Me 263.

At some point in January 1945, Junkers was awarded a full mass production contract for the newly renamed Me 263 and the first true example of the aircraft, the Me 263 V1 prototype, was completed. Its first flight, towed aloft behind a Messerschmitt Me 110, took place at Junkers' extensive Dessau facility on February 8, 1945, with test pilot Karl Wendt at the controls.

The pilot who had flown the Me 110, Hans-Joachim Pancherz, flew Me 263 V1 himself on February 11. These early flights revealed problems with the aircraft's centre of gravity, which had been anticipated, and corresponding problems with the control surfaces.

Therefore, the main landing gear wheels and struts were moved further back to correct the problem. In fact, extra attachment points for still non-retractable landing gear had been built into the design so that the centre of gravity could be easily altered.

The pilots found that the Me 263's wheeled landing gear and oleo struts were capable of absorbing shocks – such as a hard landing from a height of 5m – that would have resulted in severe back injuries for a pilot attempting the same feat in an aircraft equipped with an Me 163B-style skid.



A short fuselage, stubby wings and a narrow tail would have made the 'Julia' a difficult target in combat – but its small size also seriously restricted the amount of fuel it could carry, and reduced its endurance accordingly. via author

A total of 13 test flights were made with the Me 263 V1 between February 8 and February 19. The airframe had its rocket engine installed on March 23, 1945, but this needed to be modified by engineers from Walter Werke on March 29. All testing had come to an end by the time Junkers' airfield at Dessau was captured by the Americans on April 24, 1945.

MESSERSCHMITT ME 262 WITH SUPPLEMENTARY ROCKET PROPULSION

Several innovative and promising designs were submitted for the RLM's target defence interceptor competition but the front runner once the initial round of bids had failed to produce a winner, and perhaps the project that looked likeliest to succeed, was a rocket powered Me 262.

As previously mentioned, Messerschmitt had produced a report on September 11, 1943, which detailed a trio of 'Interzeptor' designs based on the basic airframe and components of the Me 262 turbojet fighter. Unlike many of the other designs detailed in this report, all three remained viable projects into the spring of 1944.

The trio of interceptors were renamed Heimatschützer (Home Defender) I, II and III but shortly thereafter the III design, a Me 262 powered only by a pair of rocket engines, was dropped. Work then began on actually building the Heimatschützer I in August 1944 – at around the same time that the three early Verschleissflugzeug designs were being finalised.

A production model Me 262A-1a, WNr. 130186, was taken off the assembly line and fitted with a modified tail unit with fittings for a Walter HWK 109-509 rocket engine. A part of the rear fuselage and the lower part of the rudder were also cut out to provide an exhaust for the engine.

A container designed to hold the highly corrosive T-Stoff fuel was installed in place of the aircraft's usual 900 litre forward fuel tank and the rear tank was used for the rocket engine's other fuel, C-Stoff. This left one other 900 litre tank and a 170 litre tank for the aircraft's ordinary jet fuel.

The aircraft's weapons load of four MK 108s was left unchanged and it was given the Messerschmitt designation Me 262C-1a. Its first flight, under jet power only, was on ▶

September 2 during transfer from Leipheim to Lechfeld – where it was damaged during a USAAF bombing raid on September 12. After repairs, a second flight followed on October 18.

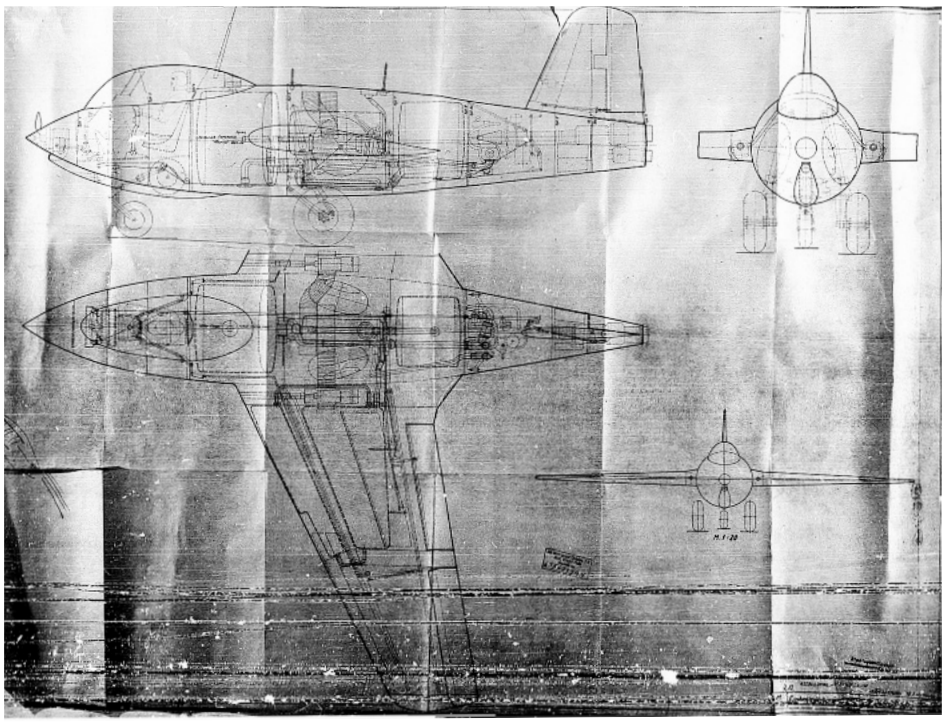
This was to test the vital system for dumping the aircraft's volatile T-Stoff fuel in an emergency. Coloured liquid was used instead of the fuel itself and the test showed that dumping the fuel might well make matters worse – since it would then coat the underside of the aircraft, particularly clinging around the undercarriage doors.

The aircraft's rocket engine, now installed, was ground tested on October 25, 1944. This revealed a host of problems that needed to be corrected – from incorrectly welded seams to fumes leaking into the rest of the fuselage – and it was November 23, 1944, before further ground tests could take place.

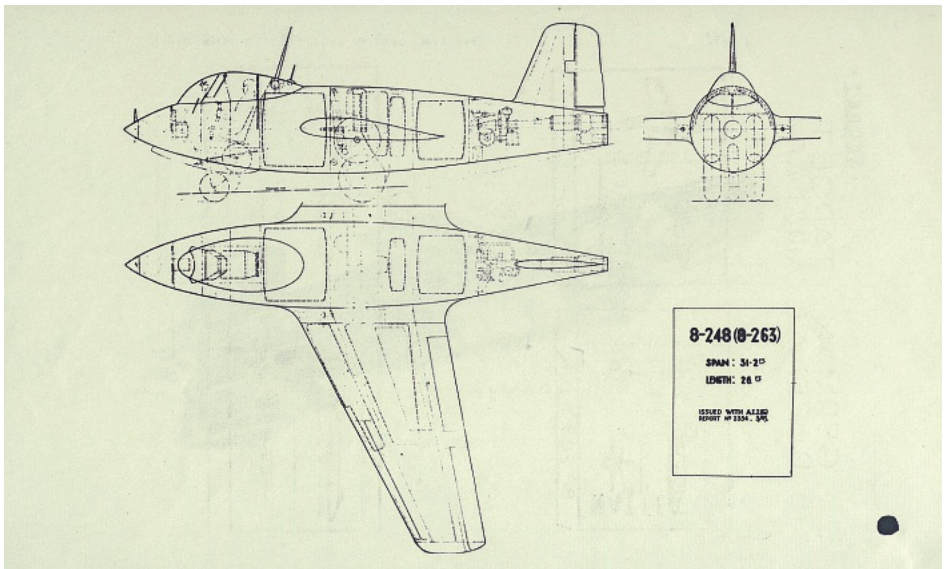
This was the day after the EHK had given the "Me 262 with supplementary rocket propulsion" top priority in its search for the ideal interceptor aircraft design. A further rocket engine ground test took place on December 2 and another fuel dumping test flight took place on December 15 – the result of which was the fuel dumping pipe being moved to the extreme rear of the aircraft so that the T-Stoff could be vented away from the fuselage.

Yet another engine test took place on December 18, revealing still more welding faults and causing a small fire in the process.

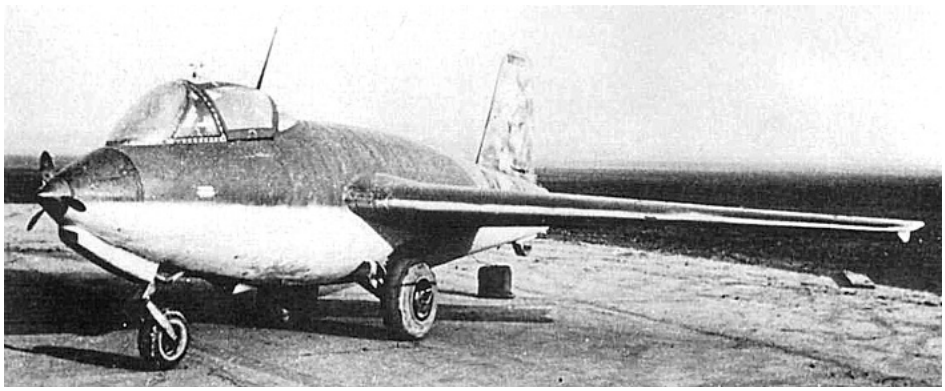
Two days later, the first prototype of the Heimatschützer II, now known as the Me 262C-2b, was transported by road to Lechfeld. This was another partially completed standard production model Me 262A-1a, WNr. 170074, but fitted with BMW 003R engines instead of its usual Jumo 004s.



ABOVE: Junkers designers, once they had the blueprints for the Me 163B, very quickly worked to address its shortcomings in a new design which reused as many of its parts as possible. The result was the Ju 248, later renamed the Me 263 – the true winner of the Verschleissflugzeug competition. via Scott Lowther



ABOVE: A somewhat simplified drawing of the Me 263 from a British intelligence report of May 1945. Note the different undercarriage arrangement to the drawing above. TNA



ABOVE: The only completed Me 263 prototype. It was test flown some 13 times before the end of the war. via author

The 003R was a standard BMW 003 combined with a BMW P.3395 rocket engine, which ran on R-Stoff and SV-Stoff, rather than the usual T-Stoff and C-Stoff. R-Stoff was Tonka self-igniting fuel and SV-Stoff was nitric acid.

The Me 262C-2b first flew, with turbojets only, on January 8, 1945. The P.3395 rocket engines were run on the ground for the first time on January 25, 1945. Immediately after igniting, the starboard engine blew up – sending jets of flame down the side of the aircraft, damaging the BMW 003 beneath it, and the wing above it.

Meanwhile, water used to clean out the engine of the Me 262C-1a after its fire had frozen inside its fuel tubes during the harsh winter conditions.

When this had finally been removed with anti-freeze in early January 1945, more ground runs commenced on January 13. A second set of runs on January 15 resulted in another fire. Yet more ground runs followed on January 29 and February 3 and another fuel dumping test took place on February 6.

More modifications were made to the engine and on February 20, 1945, a series of three engine tests were carried out without problems. This cleared the way for test pilot Gerd

RIGHT: Production model Me 262A-1a WNr. 130186 was fitted with a Walter HWK 109-509 rocket engine and became V186, the prototype Me 262C-1a. After numerous delays and problems with its fuel system, the aircraft finally flew powered by both turbojets and its rocket engine on February 27, 1945. via author

Lindner to take the Me 262C-1a up on February 27 with all three engines running.

Further successful rocket-powered flights took place on March 16 but a bombing raid on March 22 caused sufficient damage to put the aircraft out of action for the brief remainder of the war.

A new BMW 003R had been delivered to Messerschmitt for the Me 262C-2b at the end of January and ground tests on it began on February 1. When these proved satisfactory, the engine was fitted to the aircraft itself on February 7. Throughout the rest of the month, niggling faults such as electrical wiring problems and fuel tank seal failures caused more delays.

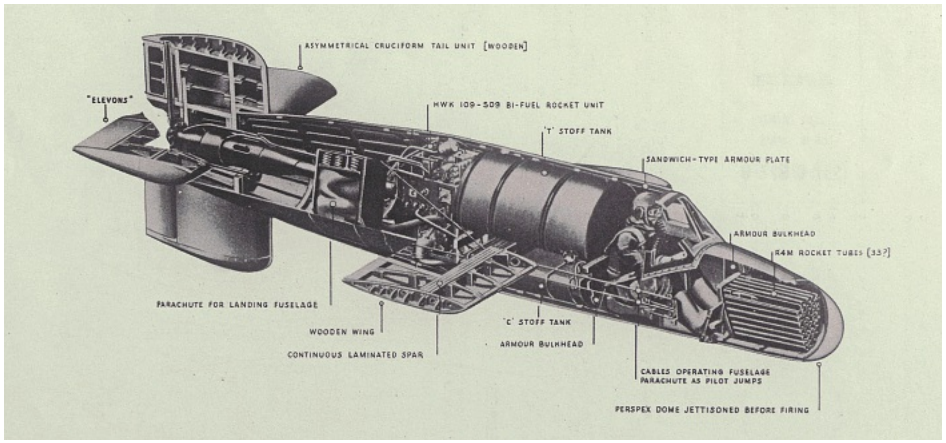
Eventually, a second turbojet-only flight was made by the Me 262C-2b on March 24, 1945. Two days later, the aircraft was successfully flown with both its turbojets and its rocket engines together during a fast climb. During another flight on March 29, however, the rocket engines malfunctioned and failed to ignite. It was to be the last time the aircraft flew.

A last attempt to come up with a workable Heimatschützer design, the Heimatschützer IV or Me 262C-3a was proposed on January 11, 1945. This involved attaching the HWK 509 rocket engine to a standard Me 262A-1a externally in the form of a fully jettisonable pack attached to the underside of the fuselage.

This could potentially turn any or even every Me 262 into a Heimatschützer and would negate all the problems of storing caustic and volatile rocket fuel within the aircraft's fuselage. The rocket pack would even attach to the Me 262's pre-existing RATO fittings.

This idea seemed so promising that three prototypes were quickly commissioned. However, there was a critical flaw in the design – the fuel tanks had to be fitted slightly lower than the engine itself, resulting in fuel supply problems which could not be overcome before the war ended.

ABOVE: Engineers examine the troublesome BMW 003R engines of Me 262C-2b prototype V074. via author



ABOVE: The Allies, particularly the Americans, were fascinated by the Bachem BP 20 Natter. This illustration from a British report uses original Bachem artwork recaptioned in English. TNA

BACHEM BP 20 (BA 349) NATTER

Behind all the other designs throughout the competition came the vertical launch Bachem BP 20 Natter. It was consistently ranked at the bottom of the heap and opposition against it grew stronger the longer it persisted as a contender.

As mentioned, by the end of December 1944 it was being actively "opposed on tactical and technical grounds" and was cancelled in reasonably forthright terms. Yet the project refused to go away and very nearly reached operational service during 1945, despite all attempts to stop it.

The unorthodox interceptor's story began five years earlier, in 1939, when a 27-year-old Dr Wernher von Braun handed the RLM a proposal outlining a fighter that could be launched vertically from the back of a lorry, up to an altitude of 26,250ft in 53 seconds before switching to horizontal flight.

The aircraft's main engine would then cut out and a smaller secondary unit would take over. When the mission was over, the aircraft would land on a skid. The RLM turned von Braun's report over to Heinkel, the company already responsible for building the world's first liquid rocket powered aircraft, the He 176, for assessment.

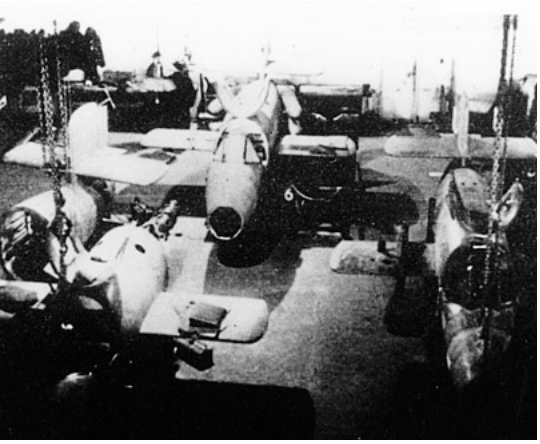
The firm's development team was sceptical about the idea but it was not entirely rejected. Next it was handed to Gerhard Fieseler Works where it formed the basis for a vertical take-off aircraft project under the designation Fi 166.

Fieseler engineers, led by the firm's 34-year-old technical director Erich Bachem, came up with two 'rider and horse' designs, where, rather than being the main engine, a rocket would simply be used to help a turbojet-powered aircraft to high altitude.

Nothing came of this, however, although Bachem did not forget it. The Fieseler company was preoccupied with other work, such as developing its Fi 156 Storch liaison and observation aircraft. Von Braun eventually resubmitted his idea in 1941 but it was then rejected outright by the RLM – presumably because, unknown to von Braun, the Me 163 rocket-powered interceptor was already at an advanced stage of development.

Bachem himself left Fieseler in 1941 and together with former Fieseler test pilot Willy Fiedler launched a new business, Bachem-Werk GmbH, on February 10, 1942, at Waldsee, Upper Swabia. The new company specialised in wooden aircraft parts and was quickly picked up as many subcontracting jobs as it could handle – working for firms such as Dornier and Heinkel.

The only wholly Bachem aircraft at this time was an ultralight known as the Lerche. Having learned of the RLM requirement for ▶



ABOVE: Natter airframes under construction within the cramped confines of the Bachem-Werk factory. via author

ABOVE: The first manned test of the Bachem BP-20 was carried out using the M1 glider towed by a Heinkel He 111. It took off from a trolley with Flugzeugführer Erich Klöckner at the controls but was destroyed on landing, Klöckner having already bailed out. via author

a Verschleissflugzeug through his industry contacts, Bachem remembered von Braun's proposal from his days at Fieseler and resolved to design something similar, which he named 'Natter' or 'Snake'.

He began with a rough sketch of something resembling a manned missile on July 16, 1944. The pilot wore a parachute while lying prone within a cigar-shaped fuselage, a rocket projectile weapon ahead of him in the 'aircraft's' nose.

Based on this concept, Bachem's professional designers went to work under the project number BP-20-01. The more he and his company worked on it, the more Bachem became personally convinced of the Natter's merit. In order to 'sell' the idea to those in authority, he wrote a sketchy, hasty-sounding outline of its purpose in a document headed 'Projekt Natter': "Annihilation of enemy aircraft especially bombers by bringing up a gunner within the immediate vicinity of the enemy and discharging rocket projectiles at him with the smallest possible amount of manoeuvring and propellant.

"No self-destruction of the pilot, on the contrary, armoured protection of him. Smallest possible production cost, maximum use of wooden parts, reduction of iron. No burden on standard aircraft industry. Exploitation of the large, partly free, timber resource. Repeated use of the most critical airframe and propulsion unit parts by parachute recovery.

"Little requirement of the pilot, due to the omission of a normal landing. Little ground input. Little transport cost. Easy transferability. Good camouflage potential."

Ahead of the project's submission for the Verschleissflugzeug competition in mid-August 1944, the design went through rapid changes. Wing and tail shape were altered, the pilot's position was shifted upwards to allow him a better view and a more detailed arrangement was worked out for the positioning of fuel tanks within the fuselage.

With no clear winner being decided at the outset, development of the BP 20 progressed rapidly during September 1944. The design was changed so that the pilot could be seated rather than prone, and the single rocket engine in the rear of the fuselage was augmented by a pair of disposable Schmidding SG 34 solid fuel boosters attached onto each side of the aircraft. As the design evolved, four SG 34s would be specified.

The launch sequence was to involve the pilot bracing himself against padded head and back rests and gripping handles on either side of the rear nose frame. On the left handle was the button to fire the boosters.

Once this was pressed, the Natter would rise under the control of a basic autopilot and after 10 seconds it would be at an altitude of 4000ft and a speed of 550mph. The exhausted boosters would then automatically detach and the Walter engine would take over.

Within another 50 seconds, the Natter would reach the same altitude as the bomber formations. The pilot would then turn off the autopilot, grab the control column and bring the aircraft around in a shallow curve to line up a target.

At a distance of 300m he would fire the Natter's weapons at the bomber. The Walter engine would then run out of fuel and the pilot would put the aircraft into a dive. Pulling out at

BELOW: Natter M23 fuelled and ready to fly. via author

low level, the pilot would activate a mechanism to detach the aircraft's nose, which would fall away, and he would then be catapulted out by the sudden deceleration – activating his parachute.

The Natter's fuselage, minus the nose, would then descend to earth on its own parachute, ready to be refurbished and reused.

It seems that during early September, the Natter was already being earmarked for rejection as the RLM expressed increasing interest in Heinkel's 'Julia' design. However, Bachem refused to accept this. He took his idea to SS-Obergruppenführer Hans Jüttner and Sturmbannführer Otto Skorzeny who took it directly to the leader of the Waffen-SS, Heinrich Himmler. Himmler agreed to meet Bachem and offered him the full support of the SS for what he called a "war deciding device".

Now under pressure from the SS, in mid-September the RLM was forced to give Bachem a contract for 15 BP-20 aircraft. In addition, Himmler sent some of his own people to oversee the project – SS-Obersturmführer Heinz Flessner, who led a team of 120 Waffen-SS construction team seconded to Bachem-Werk, and SS-Obersturmführer Gerhard Schaller.

The first Natter V1 prototype was finished on October 4, 1944, and on October 28 it was given the official RLM designation 8-349, later Ba 349, though this name was seldom if ever used at the time and the aircraft continued to be known as the BP 20.

The Natter's basic dimensions now featured a stubby wingspan of 11ft 9in, a short fuselage of 19ft 2in and a fuselage width of 2ft 11in. Construction of the 15 aircraft 'ordered' by the RLM was already well under way.

Different armament arrangements were discussed including a pair of MK 108 30mm cannon, a battery of 28 R4M rockets and a cluster of 32 single-shot 30mm cannon barrels, but no conclusion was reached.

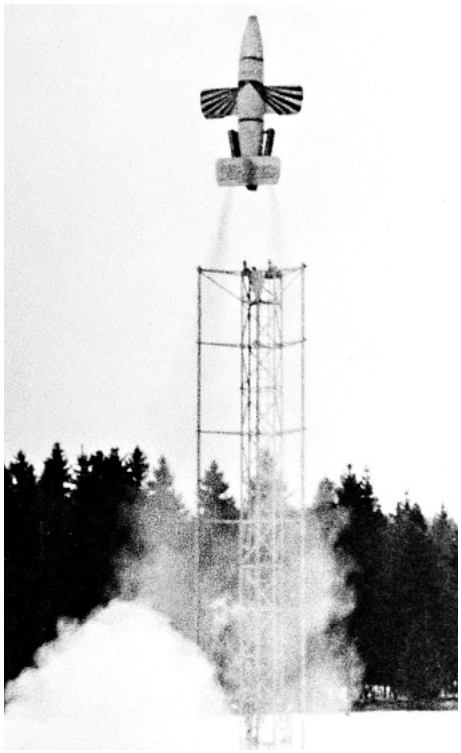
On November 3, a manned gliding trial took place with an engineless Natter airframe designated M1. It was towed along the runway behind a Heinkel He 111 on a take-off trolley with Flugzeugführer Erich Klöckner at the controls.

A Junkers Ju 87 was used as an observation platform. All three aircraft became airborne at around 4pm but Klöckner struggled to control the M1 until he moved a trim weight inside it, altering the centre of gravity. Even so, he was forced to bail out when he realised that the aircraft could not be brought into a normal towed position and therefore its parachutes could not be deployed.

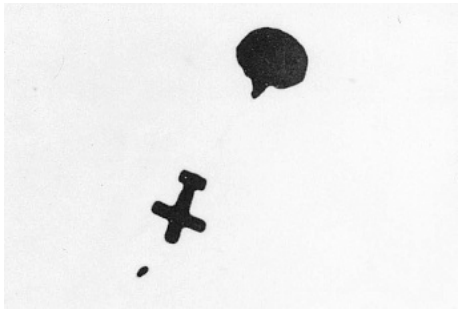
The M1 landed behind the He 111, twisted, detached and then span away, coming apart in the process.

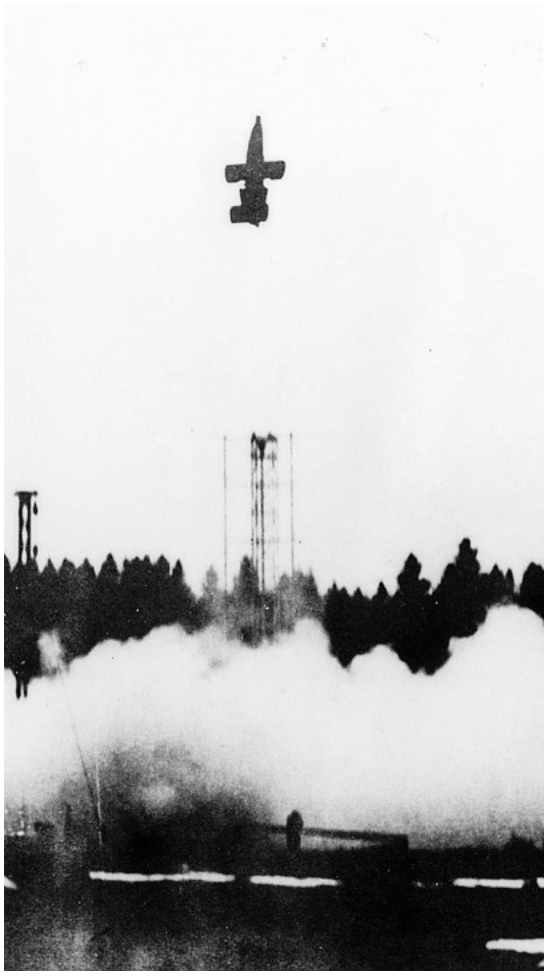
A second gilder, the M3, was fitted with an undercarriage so that it could be properly landed and reused. It was competed on November 20 – two days before the end of the EHK meeting which gave the Natter the lowest possible priority for development – and test-flown by Klöckner on December 14. Again, he was forced to bail out but this time the Natter glider landed safely without its pilot.

The first attempted vertical take-off test of the Natter was on December 18 at Heuberg – a military training area about 40 miles west and slightly north of Waldsee – using prototype M21. While the boosters went off as planned, the release clamps failed and the aircraft was engulfed in flames and burned out on the ground.



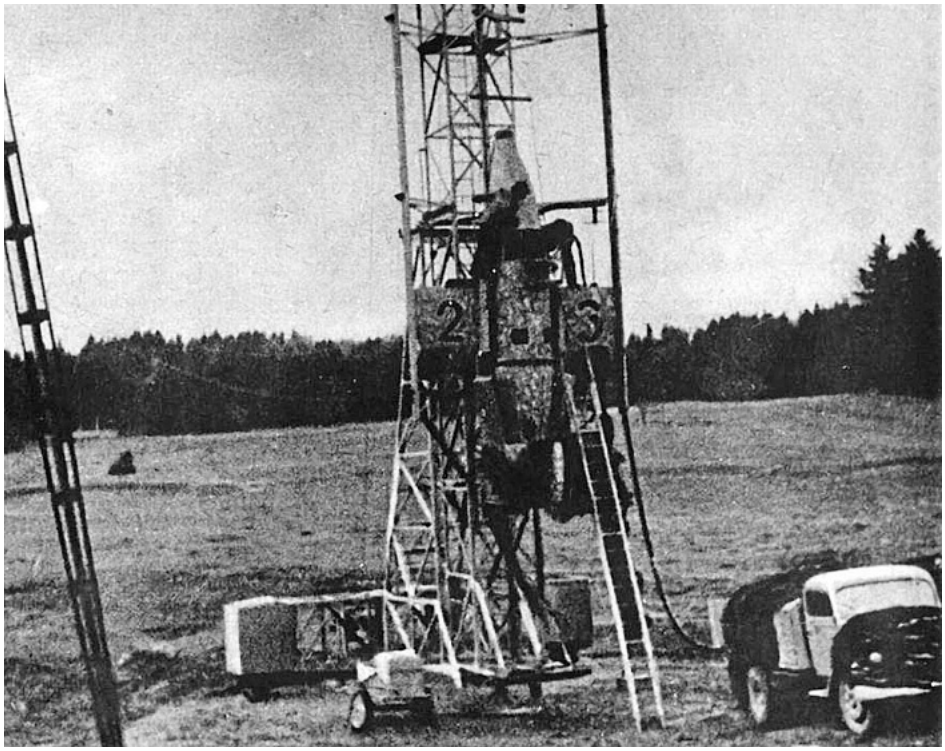
ABOVE: The unmanned M17 test vehicle was brightly painted for visibility, with asymmetrical stripes painted on its wings so that its orientation could be better discerned from photographs of the launch. via author



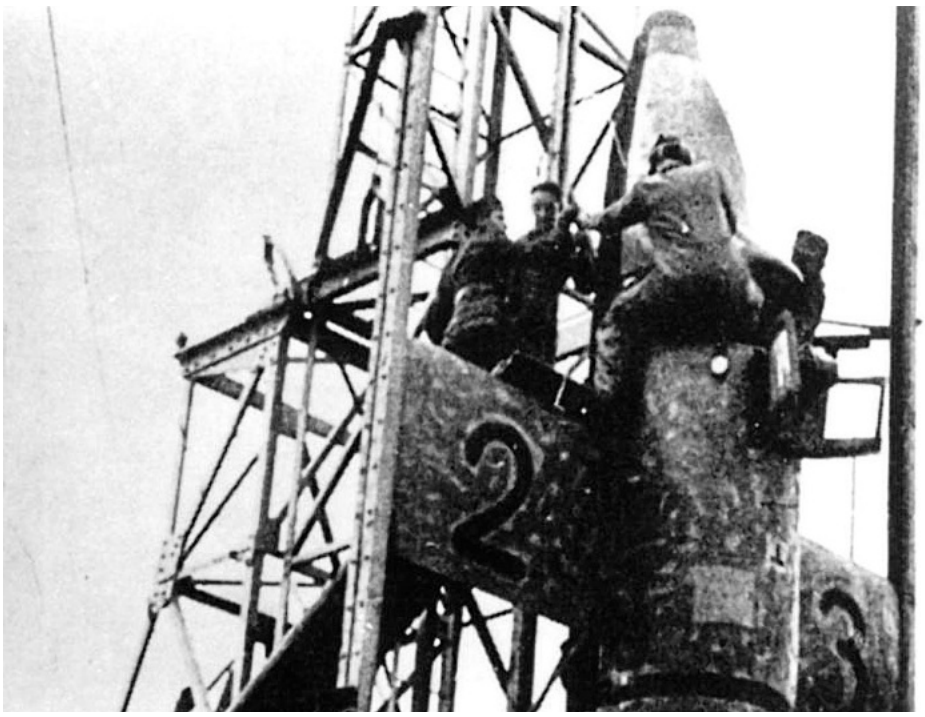


ABOVE: Fired off on December 29, M17 flew vertically as planned but its parachute detached on the way down and it was destroyed when it hit the ground. via author

LEFT: The Natter was design with a disposable nose but it was intended that the rest of the fuselage would float safely back down on a parachute once its mission had been completed. via author



ABOVE: Ground crew work to fill M23's fuel tank with C-Stoff. via author ▶



ABOVE: With nothing between him and a plunge to the ground, test pilot Lothar Sieber clambers into the Natter's cockpit legs first, assisted by ground crew. via author

On December 22, 1944, the first successful launch took place with prototype M16. It flew up to about 230ft before tipping over onto its side. It crashed 5250ft away.

That same day, the RLM again rejected the Natter but since it was now a Waffen-SS project, this mattered little.

Several vertical take-off trials of Natter prototypes took place in early 1945, including the successful test of version M22 on February 25, 1945, where a dummy pilot was fired into the sky and then floating safely down on a parachute after the nose separation was activated automatically.

The fuselage parachute also activated but traces of fuel left in the Walter engine's tanks ignited and M22 was burned out.

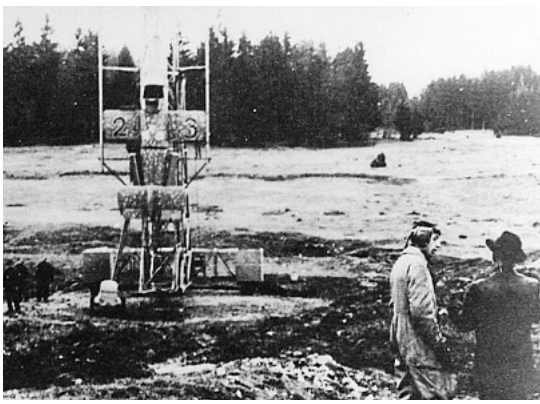
The first manned test, with pilot Lothar Sieber at the controls of M23, was scheduled for March 1. The aircraft had a safety chute to decelerate the fuselage as the pilot bailed out – in place of a parachute to 'rescue' the fuselage, which was to be sacrificed on this occasion – rudders were installed in the tail and the elevons were enlarged by 20%.

There was a pitot tube on the right wing for monitoring air speed and other sensors were fitted to monitor the aircraft's performance. There was no autopilot – the control column had been fitted with a slight depression of two degrees but otherwise Sieber would have to hold it in the neutral position during take-off.

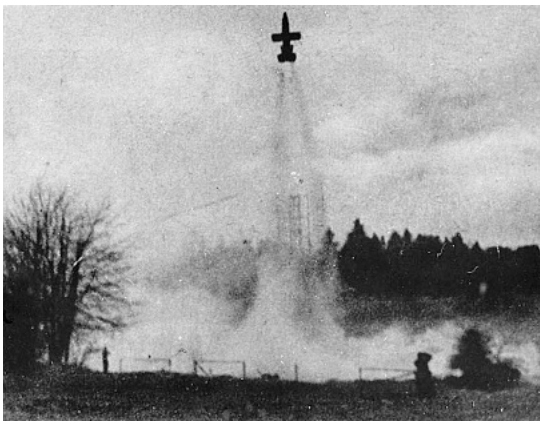
At close to 11am, Sieber was helped into the cockpit by a trio of ground crew and the canopy hatch was closed. The Natter's main engine was fired first and allowed to build up to full thrust, with the aircraft locked firmly to the launch tower, before Sieber then ignited the SG 34 boosters.

The locking mechanism was released and the Natter shot upwards. After climbing to about 330ft, the aircraft began to curve onto its back at an angle of about 30 degrees – then the canopy hatch flew off unexpectedly. The aircraft continued its ascent to about 5000ft whereupon it disappeared into a bank of low-lying cloud.

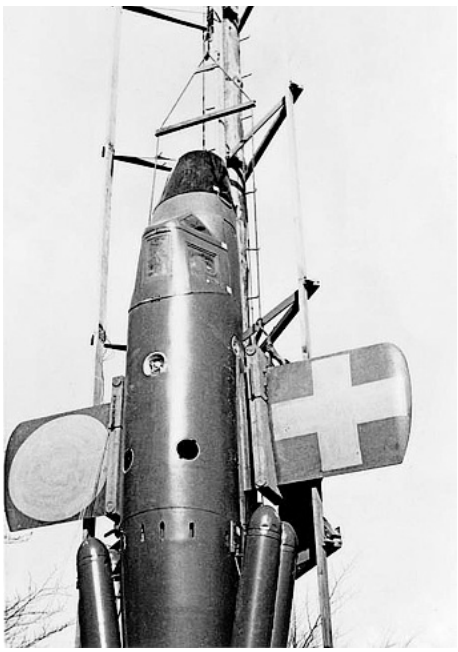
Just 15 seconds into its climb, the Natter's engine stopped and it rolled right over onto



ABOVE: Test pilot Lothar Sieber, in the foreground wearing overalls and a flying helmet, shortly before his first and only flight in BP-20 M23. via author



ABOVE: M23 is launched on March 1. via author



ABOVE: M52 attached to its pole launcher. via author

ABOVE: With Lothar Sieber dead, the Natter test programme reverted to unmanned testing. Here, vehicle M52 is winched into position on a newly designed single-rail tower. via author

its back before entering a nose dive. Several kilometres from the launch site, and after less than a minute of flight, M23 crashed vertically into the ground.

The crater left by the impact was 5m deep and when it was excavated a small shard of Sieber's skull was found. What little remained of him was buried with full military honours in the cemetery at Nusplingen.

The investigation carried out by Bachem-Werk afterwards had little hard evidence to go on but attention was concentrated on the canopy hatch that had broken away from the aircraft during its ascent. It was recovered intact not far from the launch site and the latch meant to fasten it in place appeared to be bent.

Over the next few days a sequence of events was pieced together. It was suggested that for the first few seconds after take-off, Sieber's body would have been subjected to forces of about 3G – pinning him back in his seat and applying backwards force to his arms.

Since he was holding the control column, this would account for the aircraft curving steadily onto its back. As the aircraft became increasingly upside down, Sieber's body would have been pushed up against the hatch – his seatbelt having enough 'give' to allow this to happen. The latch might well have then failed, causing the hatch to be caught by the slipstream and spin away.

The pilot's headrest was a part of the hatch so when it suddenly parted company with the aircraft, Sieber's head would have been violently flung back 25cm, against the wooden rear wall of the cockpit. This was likely to have concussed him, rendered him unconscious or may even have broken his neck.

It was considered possible that a dazed Sieber might have shut down the rocket engine himself after 15 seconds but it was equally possible that the odd angle of ascent might have caused air bubbles in the Walter engine's fuel, causing it to cut out.

Either way, the Bachem team felt they had been pressured into conducting a manned launch too early. It seemed as though Sieber's accident might have been avoided if an autopilot had been available to prevent the control column from moving.

The first Natter to be flown with automatic guidance, M14, flew on March 16. After a successful take-off, it went into a spiral and was destroyed after its safety chute failed to prevent a hard landing.

A total of seven further vertical launches were carried out from the tower after Sieber's death and plans were advanced to bring the Natter into service under the code name Krokus. This was chosen because the crocus blooms in March, when the attacks on bombers had very optimistically been expected to begin.

A mobile pole launcher was designed for use with the Ba 349A-1 and a test machine, M52, was successfully fired from it some time after April 5. Ten production Natters, still regularly referred to as BP 20s, were under construction during late March and into early April. The final armament of a nose-mounted honeycomb type launcher for 24 Henschel Hs 297 Föhn rockets was fitted.

A handful had been completed by mid-April when French ground forces entered the vicinity of the Bachem-Werk factory. Attempts were made to put the Natters into operation but in reality the personnel involved were only just able to keep the aircraft away from the advancing Allies by driving them around on the back of trucks.

Four lightly damaged Natters and the personnel accompanying them were captured at St Leonhard in Austria on or around May 6, 1945.

It was an ignominious end to the real winner of the Verschleissflugzeug competition. Despite all the obstacles placed in its way, Bachem's Natter came as close as the nominal winner of the contest, the Me 263, to completion, if not somewhat closer.

The requirement for a target defence interceptor was issued at a time when the Third Reich was under great pressure but was not yet facing absolute defeat. Great resources were still at the disposal of the German aircraft manufacturers during the summer of 1944 but the technological challenges of attempting to build an interceptor that could outperform the Me 163 – which had been years in the making – were simply too great.

The sole manned flight of the Natter was the first time in history that a piloted vehicle had been launched vertically under rocket propulsion. At this time Germany was not resting its hopes of causing mass destruction of the American bomber force solely on manned aircraft, however. A whole host of surface-to-air missile systems were under development, but none of these was truly effective nor were they ready for operational service before the end of the war.

Even if a manned rocket-powered interceptor could have been developed and put into service during 1944-45, this would not have solved Germany's other great aerial defence problem – that of the RAF bomber force which attacked during the night. ●

ABOVE: The business end of the Bachem BP 20 Natter's Föhn rocket launcher. The Natter project faced rejection at every turn yet succeeded, to a degree, where many others failed. via author

ABOVE: Americans examine one of four damaged production Ba 349A-1 Natter aircraft captured in Austria. via author

Flying blind

Schlechtwetter und Nachtjäger (summer 1944)

As Britain's night-flying Bomber Command forces grew and became ever more sophisticated, so too did the Luftwaffe's need for an effective night fighter become ever more pressing. By the beginning of 1944, Germany was losing the game of technological game of cat and mouse that was radar and countermeasures development and urgent action was required…

German night fighter designs had been exclusively piston-engined until 1944. While work was being carried out to produce jet-propelled day fighters, reconnaissance aircraft and bombers, new piston engine designs such as the Heinkel He 219 Uhu and Focke-Wulf Ta 154 were being prepared for the Luftwaffe's night fighter units.

The former first flew on November 6, 1942, while the latter first took to the air on June 1, 1943. However, while both were advanced designs, neither aircraft could match the performance of the night fighter version of the de Havilland Mosquito, which began intercepting German night raiders in mid-1942.

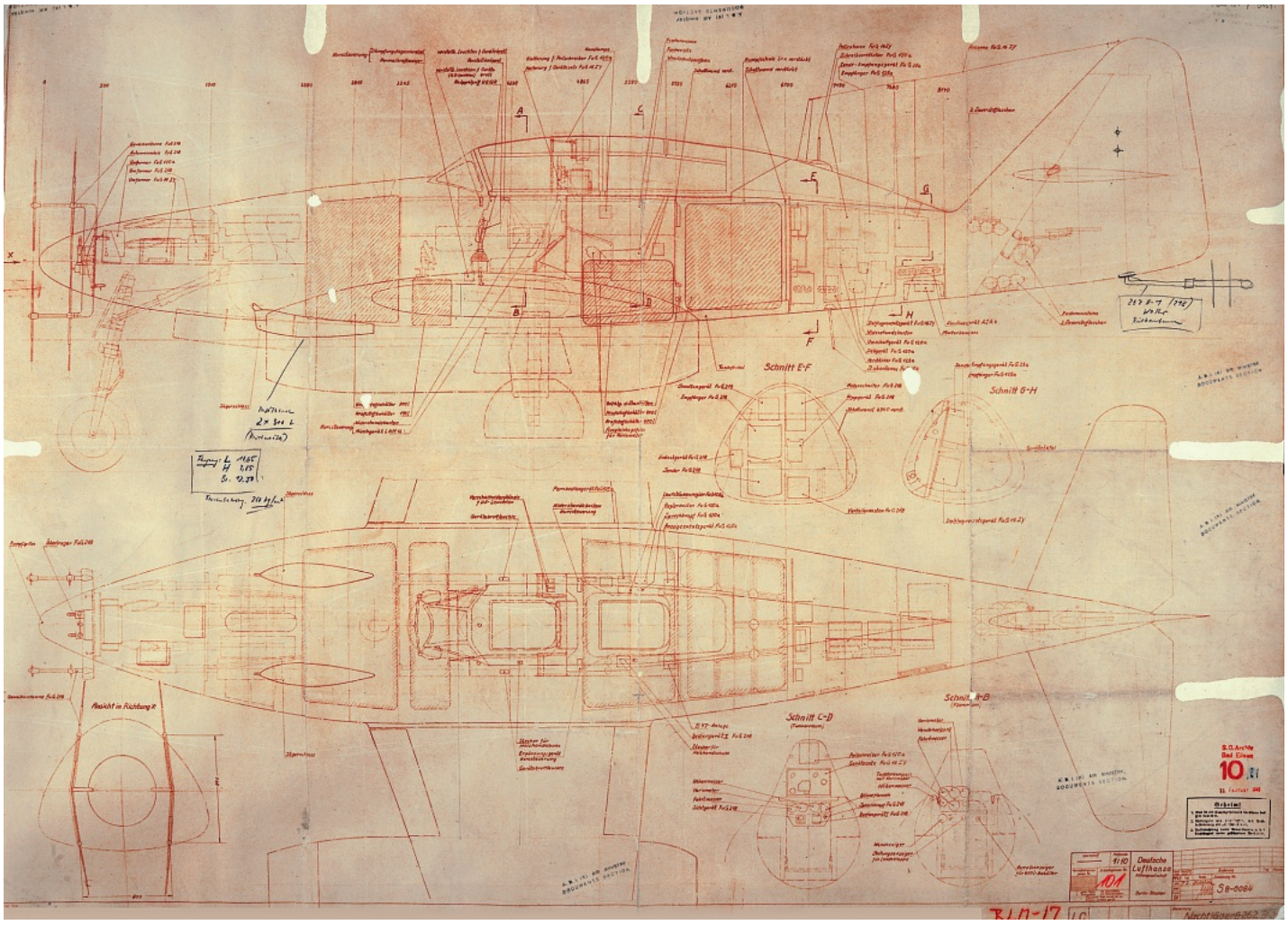
In addition, both types were beset by development difficulties – the He 219 with its engines and the Ta 154 with the glue used in its wooden construction – which left the Luftwaffe soldiering on with outdated conversions of heavy fighters and bombers such as the Messerschmitt Bf 110G-4, Junkers Ju 88Cs and Gs, and Dornier Do 217Ns.

It was finally decided, during the summer of 1944, that the most advanced German aircraft then in production, or almost in production, should be developed and modified for use as interim night fighters while work was carried out to produce a purpose-built aircraft to do the job.

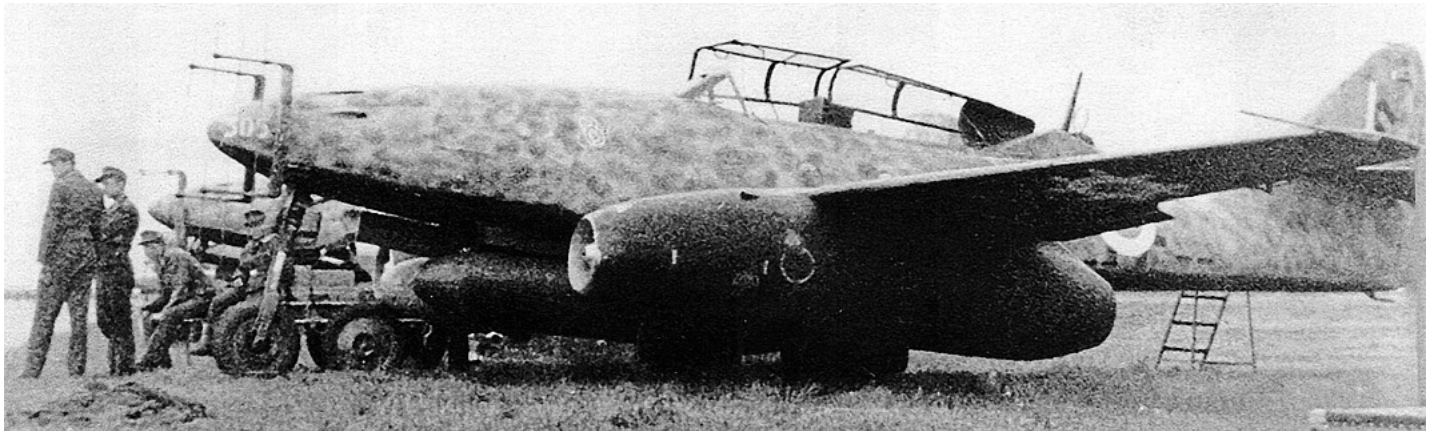
Messerschmitt, Arado and Dornier were asked to put forward proposals for their Me 262, Ar 234 and Do 335 designs respectively. These were followed, in December 1944-January 1945, by improved and updated proposals from all three companies.

MESSERSCHMITT ME 262B-1A/U1

Proposals for a Me 262 night fighter with two seats and radar equipment were drawn up



ABOVE: Messerschmitt/Deutsche Lufthansa drawing S8-0084, dated February 7, 1945, showing the planned production version of the firm's two-seater jet night fighter, the Me 262B-2. None were built and only a handful of even the interim version, the Me 262B-1a/U1 reached front line service. TNA



ABOVE: This distance view of the same captured aircraft as that pictured below shows the sheer length of the cockpit of the two-seater Me 262. via author

shortly before September 1, 1944. The aircraft was to be based on the trainer version of the type, which already had two seats.

The dual controls were to be removed and replaced with two new 140 litre fuel tanks, one on either side of the rear seat. This would give the aircraft a total fuel capacity of 2070 litres – with the option of adding two 300 litre drop tanks externally and another 900 litres in a winged fuel tank that could be towed behind the aircraft.

The rear position was to be occupied by a FuG 218 Neptun V airborne interception radar and its operator. It was intended that a FuG 350 Naxos Zc homing device should also be fitted.

Design work on the Me 262 night fighter, known today but possibly not at the time as the Me 262B-1a/U1, progressed rapidly and by late January or early February 1945 work began on creating the first examples at the Berlin-Staaken workshops of Deutsche Lufthansa.

A number of Lechfeld-built Me 262A-1as were delivered to the facility and underwent significant modifications. The radar operator's position was put together using roughly finished sheets of plywood to house the equipment and instruments and it is likely that the Naxos device was never fitted to any of the small number of examples built – most likely between six and 12.

While the Luftwaffe waited for deliveries of its first jet-powered night fighter, a unit was set up by night fighter ace Leutnant Kurt Welter to test the standard Me 262A-1a during the hours of darkness. Based at Rechlin-Lärz, Kommando Welter flew a series of night time interception missions against RAF aircraft from November 2, 1944, into early 1945.

The unit was redesignated 10./NJG 11 on January 25, 1945. It received its first Me 262B-1a/U1 on March 22 and only four of these aircraft are known to have seen action before the war ended.

ARADO AR 234B-2/N

The first proposal for Arado's interim night fighter is dated September 12, 1944. It was decided that 30 Ar 234B-2 bomber airframes should be modified under the designation Ar 234B-2/N.

Like the Me 262B-1a/U1, the Arado aircraft was fitted with a compartment for a second crew member who operated a FuG 218 Neptun V radar. Unlike the Messerschmitt design, the Arado's radar man had to sit in a very cramped compartment built into the rear fuselage with a small window above his head.

ABOVE:Towards the end of 1944, Messerschmitt set out proposals for a night fighter conversion of its two-seat Me 262 trainer, the B-1a, as the B-1a/U1 interim night fighter. Just a handful were completed. This example is pictured after the war in British hands. via author

In addition, while the Me 262B-1/U1 could simply retain the Me 262A-1a donor airframe's original armament of four MK 108s, the Ar 234B-2 had no defensive armament at the outset. Therefore, the conversion process also entailed the fitting of two MG 151 20mm cannon in a large streamlined gun pod under the fuselage.

It is believed that just two of these interim machines were produced but it was quickly found that the Ar 234B-2's extensively glazed cockpit did not suit night time operations. During a meeting of the EHK's special commission for the development of night and bad weather fighters on February 24, 1945, Leutnant Welter stated: "I consider the full vision cockpit provisionally proposed by Arado for night fighting completely unsuitable and would prefer a staggered cockpit.

"I base this on two factors. Firstly, there is the danger to which the pilot is exposed from pieces of debris flying off the enemy aircraft when it is shot down at close range. Secondly, there are exceptional problems caused by reflection phenomena during take-off and landing."

DORNIER DO 335A-6 AND P.254

The Do 335, with one piston engine at the front and another at the rear of the airframe, had been plagued by problems during 1944.

Designed in late 1942, the aircraft made rapid progress during its early development and showed great promise as potentially the fasted piston-engined aircraft in the world. It was scheduled for the beginning of mass production during the spring of 1944 but an American bombing raid in March destroyed all the tooling and carefully prepared jigs needed for its manufacture.

Yet even as Dornier attempted to restart its crippled fighter programme, its designers were working on a new variant of the type as an interim night fighter in September 1944 – the Do 335A-6.

At a meeting of the EHK on October 17, 1944, it was proposed that most of the planned Do 335A-1 fighter production should be converted to A-6 standard.

As with the Messerschmitt and Arado designs, a rear compartment was to be created for a radar operator. This was to be positioned facing forwards directly behind the pilot, with the fuselage fuel tank accordingly reduced in ▶

size to accommodate it. Like the Arado 'back-seater', the Do 335's radar man benefitted from a small glazed panel above his head that was flush against the line of the fuselage.

The standard aircraft's armament of one 30mm MK 103 and two 20mm MG 151 was kept but additional fuel tanks were to be fitted into the aircraft's wings to make up for the capacity lost in allowing for the radar operator's position.

Three night fighter prototypes, Do 335 M15, M16 and M17 were initially built. M15 first flew on October 31, 1944, with the rear position complete and with aerials for the FuG 218. M16 had more advanced aerials and went to Werneuchen's radar test centre for evaluation on January 23, 1945.

A single Do 335A-1 aircraft was modified to Do 335A-6 standard – prototype V10, WNr. 230010 – and was flown to Werneuchen the following day.

Do 335 M17 was not completed before the end of the war and none of the three completed prototypes saw active service.

At around the same time that the Do 335A-6 was being worked on, September 1944, the designers of Dornier were simultaneously working on another night fighter based on the basic Do 335 airframe but with mixed piston engine and jet propulsion under the designation P.254/1.

This was to have either a Daimler-Benz DB 603 IA or a Jumo 213J engine in its nose, with a HeS 011 turbojet mounted in the rear engine position, with large intakes on either side of the rear fuselage to feed it. In addition to a pair of fixed forward-firing MG 151s, the P.254/1 also had at least one MK 108 positioned to fire upwards at an oblique angle for attacking enemy bombers from below.

MESSERSCHMITT THREE-SEATER NIGHT FIGHTER

With work either under way or about to commence on the serial production of its Me 262B-1a/U1 interim night fighter design, Messerschmitt put forward several proposals for a more complete development of the Me 262 to fulfil this role.

The first of these, published on January 18, 1945, involved relatively small modifications to the design. The fuselage was to be lengthened by 1.5m to provide room for the radar operator behind the pilot without reducing internal fuel tank capacity.

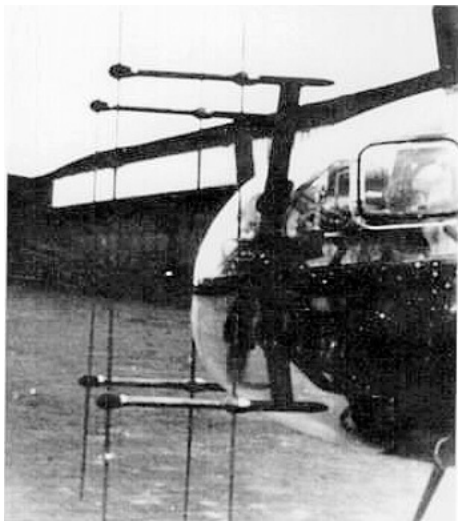
The canopy over the men's heads was to be made taller to accommodate the bulky FuG 350 Naxos Zc homing device scanner and the radar operator was even to be given blackout curtains so that it could be read more easily. Radar aerials would naturally be fitted to the aircraft's nose unit too.

Another, far more radical, design of February 1945 featured the possible inclusion of a third crewman – a navigator – within the stretched fuselage and a pair of HeS 011 engines but buried in the aircraft's wingroots. The wings themselves would also have a 45 degree sweepback, compared to the standard Me 262's sweep of just 18.5 degrees.

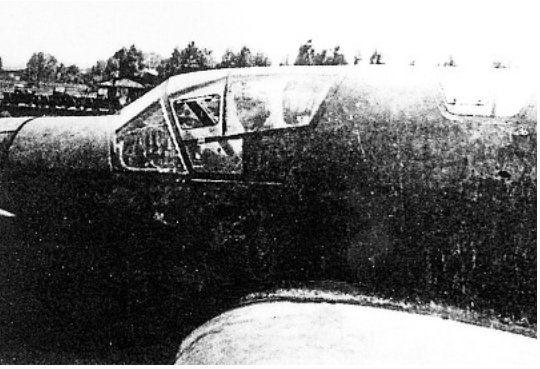
In March, more two- and three-seater designs followed, one with less swept back but more thickly corded wings and with the engines underslung, and another with a similar layout but with the engines once more buried in the wingroots.

ARADO AR 234P-5

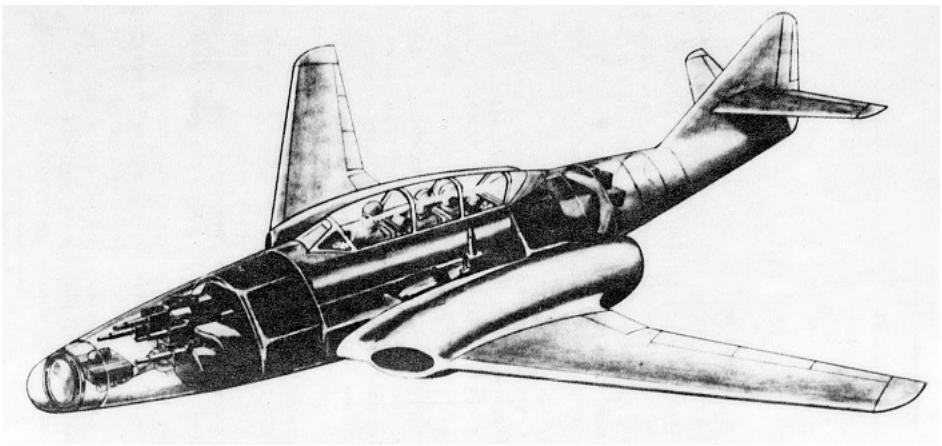
With the Arado Ar 234B-2/N night fighter being found, at best, to be of lesser value than the Me 262B-1a/U1 and at worst to be



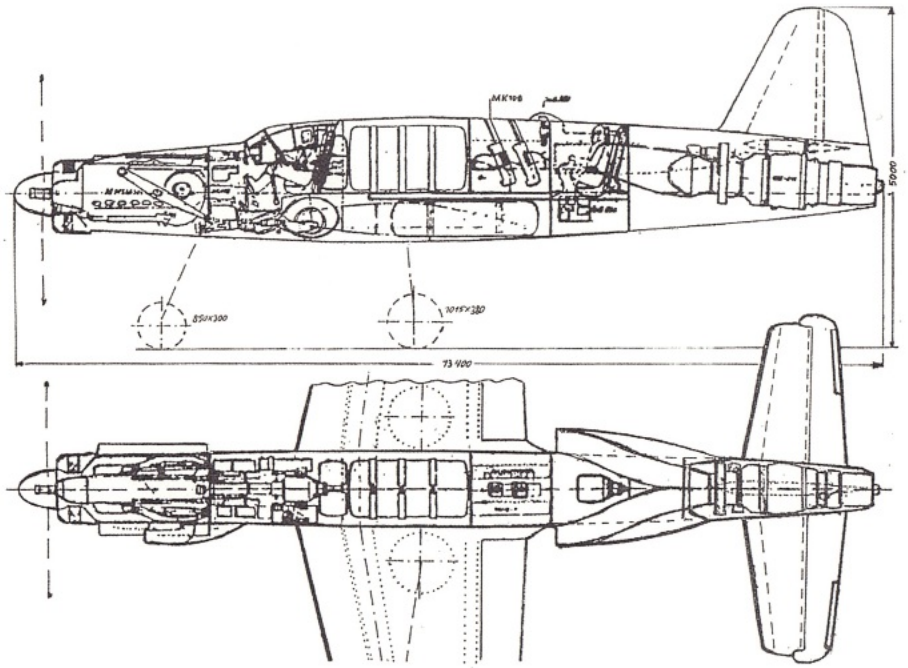
ABOVE: Little concrete evidence of Arado's interim night fighter, the Ar 234B-2N, remains. This photo shows the glazed nose of one, fitted with radar antenna. It was quickly found that the Ar 234B-2's bulbous glass cockpit did not suit night time operations. via author



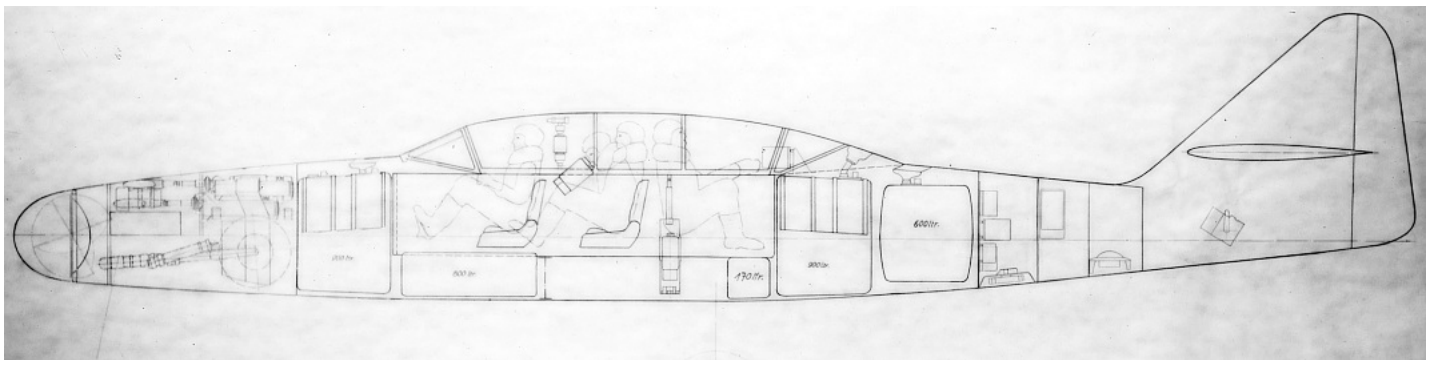
ABOVE: As with all proposed variants of the Dornier Do 335, grand plans were laid for production of the Do 335A-6 night fighter variant but none saw service during wartime. This photograph of development aircraft Do 335 M17 shows the glass panel beneath which the radar operator was to sit in the production 335A-6. The aircraft was completed by the French after the war. via author



ABOVE: A Messerschmitt drawing showing the company's advanced three-seat night fighter. This grainy image, from a report captured by the Americans, was passed to the British on microfilm. GDC



ABOVE: Plans for Dornier's P.254 mixed propulsion night fighter from an American report. Unlike the Do 335A-6, where the radar operator sat directly behind the pilot, the P.254 had him seated much further back in the rear fuselage, between the twin intakes for the jet engine. GDC



ABOVE: Detailed side view of the Messerschmitt three-seater night fighter dated March 17, 1945. GDC

completely unsuited to night fighting, the company set about rapidly amending the design.

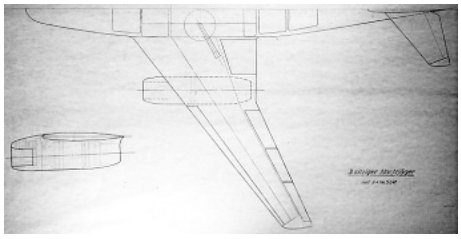
Since the next projected development of the slender jet reconnaissance/bomber aircraft was to be the multirole 'C' series, it was logical that this might become a platform for a better night fighter version of the Ar 234. This was duly drafted and designated Ar 234C-3N. This, however, kept the fully glazed nose of its predecessor and was therefore unlikely to be acceptable to the Luftwaffe.

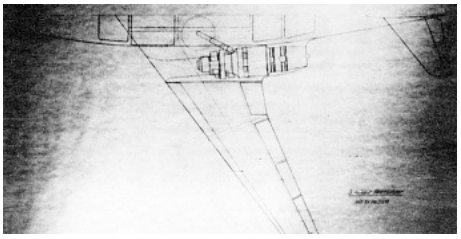
A new approach was taken for what was initially known as the Ar 234C-5N, then the Ar 234C-7. This design featured a lengthened nose, providing room for the pilot and a second crewman to sit side by side. The full vision cockpit was no longer a feature, with an unglazed nose and a more fighter-like canopy above the crew.

This apparently seemed such an attractive arrangement that on January 19, 1945, the Ar 234C-7 design was given the new designation, Ar 234P, and expanded into five new sub-types of which the last, the Ar 234P-5 was the most promising. The P-1 had four BMW 003 jets and a crew of just two – pilot and radar operator. It was to be armed with a single MG 151 and a single MK 108. The P-2 was similar but had a cockpit protected by 13mm thick armour plate. The P-3 had only two engines – a pair of HeS 011s – and a heavier armament of two MG 151s and two MK 108s. In addition, the cockpit was reduced to a single seat, with the radar operator once again relegated to the rear fuselage.

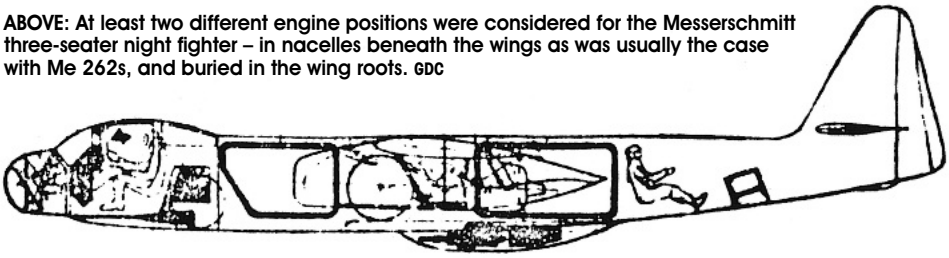
The P-4 was the same as the P-3 in every respect except its engines, which were to be Jumo 004Ds. Finally, the P-5 had two HeS 011 engines but also a third crew member, the radar operator, who still had to sit in a small compartment at the rear of the aircraft. Armament was three fixed forward firing guns – an MG 151 and two MK 108s – and two MK 108 positioned to fire upwards at an oblique angle.

Beyond the P-5, Arado was to design two further dedicated night fighters which will be discussed later. ●

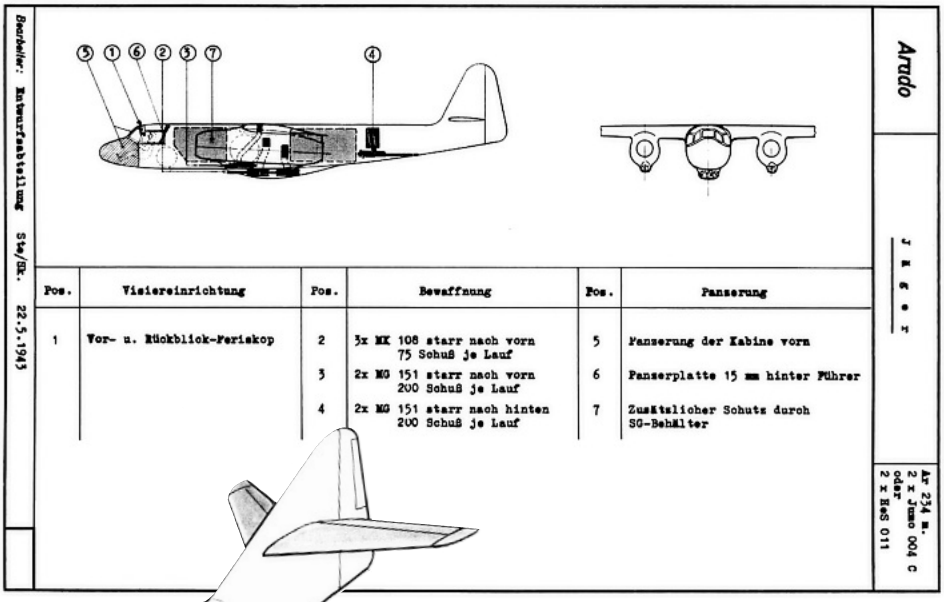




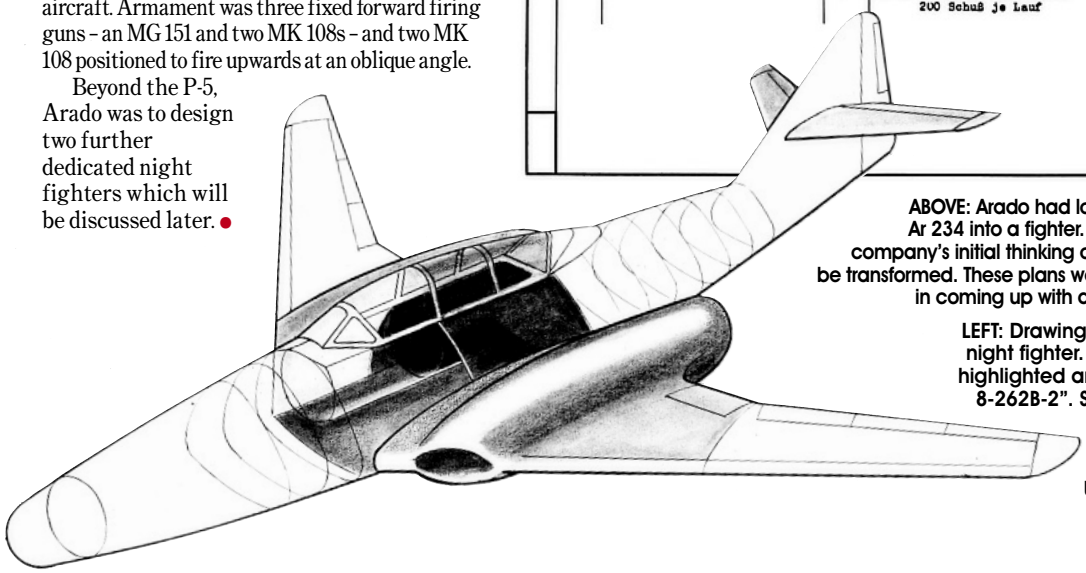
ABOVE: At least two different engine positions were considered for the Messerschmitt three-seater night fighter – in nacelles beneath the wings as was usually the case with Me 262s, and buried in the wing roots. GDC



ABOVE: A low quality reproduction of Arado's design for the Ar 234P series. Some of the Ar 234 'fighter' features are retained, such as the under-fuselage cannon pack, but the cockpit has been given a snub nose to house the radar unit and a longer bubble canopy. As with the Ar 234B-2N, however, the radar operator was still to be positioned within the rear fuselage. TNA



ABOVE: Arado had long considered the possibility of turning the Ar 234 into a fighter. This drawing from May 22, 1943, shows the company's initial thinking on how the reconnaissance machine could be transformed. These plans would undoubtedly have been reconsidered in coming up with a night fighter version. via www.deutscheluftwaffe.de



LEFT: Drawing showing the Messerschmitt three-seater night fighter. The caption suggests that the drawing's highlighted areas show "substantial changes over the 8-262B-2". Since this design itself is often referred to as the Me 262B-2, it must be presumed that the Me 262B-2 was actually the production version of the Me 262B-1a/U1, and that the three-seater was simply the 'Messerschmitt three-seater night fighter' at this stage. GDC

Messerschmitt believed it was onto a winner with its advanced and flexible P.1101 entry for the 1-TL-Jäger competition. It was to be sadly disappointed. Art by Ronnie Olsthoorn

The future of fighters

1-TL-Jäger (July 1944)

The summer of 1944 saw the limitations of the Me 262 becoming readily apparent. The basic design predated the war, it was heavy and expensive, and it required two precious jet engines. A cheap high-performance replacement was needed that could make do with just one…

A requirement for a new single-jet high-performance fighter, known as the 1-TL-Jäger, was issued in July 1944 and Germany's aircraft manufacturers were quick to realise that this was potentially the most important competition in which they had so far had the opportunity to participate.

Designing a successful single-seat fighter carried a huge amount of prestige and the most famous fighter firms – Messerschmitt, Focke-Wulf and Heinkel – jumped at the chance to create the successor to not only the Me 262 but perhaps also the Bf 109 and Fw 190 too.

The general staff of the Luftwaffe set out ambitious performance goals for the new fighter in the requirements of the contest. It needed to have a top speed of 1000kph (621mph), an endurance of one hour at 7000m (23,000ft), armour protection for the pilot and standard fighter equipment such as gunsight and radio.

The engine was to be a Heinkel HeS 011 turbojet, armament was to be two MK 108 30mm cannon and the companies, including Blohm & Voss to make a total of four, were allowed two months to prepare their first designs.

These were presented at a meeting at Messerschmitt's Oberammergau facility on September 8-10, 1944, and although a Blohm & Voss representative attended, the company deferred presentation of its design since it was apparently not yet ready.

It is not known precisely which designs were presented by Messerschmitt and Heinkel, though it is likely that these were one of the earliest versions of the former's P.1101, and the latter's P.1073 or a variation of it. Focke-Wulf put forward a twin-boom design it had been working on since the start of the year.

During the meeting it became clear that the three companies that had made presentations had each used a different set of calculations to work out the performance of their proposed machine.

It was therefore decided that a single formula should be used in the assessment of all the designs. However, the details of this formula could not be agreed. It was agreed, however, that Junkers should also be allowed to submit a tender for the requirement.

On the last day of the meeting, a new requirement was suddenly, and for the most part unexpectedly, issued for what would become the Volksjäger – full details of which are given elsewhere in this publication.

This urgent demand for new single-jet fighter designs that could be built in a hurry from low grade non-strategic materials effectively stalled work on the 1-TL-Jäger competition for several months, particularly since Blohm & Voss, Focke-Wulf, Heinkel and Junkers all hastily drafted entries for the Volksjäger contest.

With Heinkel's P.1073 having been chosen for as new Volksjäger, a second presentation of designs took place on December 15 with Heinkel now fielding a new and more complex design, the P.1078, and Messerschmitt replacing its P.1101 with what it regarded as the more advanced P.1106 and P.1110.

Still no agreement could be reached on a formula to assess performance so it was decided that the Deutsche Versuchsanstalt für Luftfahrt (the German Aviation Research Establishment, the DVL) should compose it.

At a third meeting, on January 12-15, 1945, the DVL put forward its new mathematical formula. This was agreed and a date was set for a third round of 1-TL-Jäger design submissions – February 27-28, 1945.

A report on preparations for this meeting has survived and gives a good idea of the issues surrounding the competition at this late stage of the war.

It states: "Subject: Comparison of designs for single-jet fighter, Upper Bavarian Research Station, Oberammergau. Summary: The report gives a concise statement of the most important technical points and sizes for comparison of the 1-TL-Jäger.

"The performances are determined from general characteristics (performance adjustment according to Deutsche Versuchsanstalt für Luftfahrt).

"Preface: At the request of the Entwicklungs Hauptkommission and the head of the Technische Luft Rustung, designs for single jet fighters were tendered by the following firms: Blohm & Voss, Focke-Wulf, Ernst Heinkel, Junkers, Messerschmitt.

"At the meeting of the Entwicklungs Hauptkommission on February 27-28, 1945, a decision concerning the completion of these designs is to be made.

"The purpose of this report, after careful work on the material in question, is to present a comparison between the designs tendered, and, thus, is to serve the EHK as the basis for decision.

"A considerable interruption of the work necessary for this report was brought about by war conditions. On account of the bad traffic and communication facilities, it was not possible to obtain in written form the report of the DVL on general performance and criticism of the characteristics of the aircraft.

"For the same reasons it was not possible to compare in the general discussion with DVL the additional designs tendered (design from Heinkel and designs P.1101 and P.1111 from Messerschmitt).

In order to ensure the fairest possible comparison, reference was made to the performance and weights of all the designs submitted with regard to equipment and armament.

"The aircraft weights were determined against each other at the beginning of the performance comparison. The bullet-proofing was not assumed to be of equal weight for the individual designs, but the bullet-proofing for each plane was set out so that an equal extent of protection was obtained wherever possible.

"Exceptions can be made for designs P.1101 and P.1111 from Messerschmitt, as these have to be considered with a view to their stronger armament (3 x MK 108 and 4 x MK 108 respectively, instead of 2 x MK 108). This happened on account of the fact that the arrangement of the supplementary armament at the extreme front of the aircraft presented great difficulties on both models in regard to the centre of gravity, and thus the firm provided additional armament as a fundamental.

"The design of EHF (Heinkel) was not included in the comparison of performance and weight, as it was not ready at the time. The comparison was finished, but the result has not yet been submitted at this time to Special Commission for Day Fighters. The estimated performances are thus the firm's specifications.

"The estimated performance for the designs P.1110, P.1101 and P.1111 from Messerschmitt do not correspond entirely to the values which were ascertained at the comparison of performance. For the design P.1110, an increase of wing and fuselage surface is contemplated and considered according to the fundamental process of calculating the performance comparison.

"The designs P.1101 and P.1111 which were not submitted for the performance comparison by Messerschmitt, were calculated by the firm according to an agreed process and were submitted for decision in place of the project P.1106.

"The estimated performances are comparative figures, which will serve as the deciding factor for the value of the designs submitted. They are not to be considered as absolute estimates of the velocities.

"The report consists of a short description, in concise form, of the separate projects, with the most important technical points such as the main dimension weights and important performances in comprehensive tables. These served the Special Commission for Day Fighters on January 12, 1945, as a basis. In the meantime, alterations proposed by the firms have not been considered."

The eight contending designs were the Blohm & Voss P.212, Focke-Wulf 'I', Focke-Wulf 'II', Heinkel P.1078, Junkers EF.128, Messerschmitt P.1101, Messerschmitt P.1110 and Messerschmitt P.1111. ●

MAXIMUM FUEL CAPACITY

1.	Focke-Wulf II	2100 litres
2.	Junkers EF.128	1570 litres
3.	Messerschmitt P.1101	1500 litres
4.	Messerschmitt P.1110	1500 litres
5.	Messerschmitt P.1111	1500 litres
6.	Heinkel P.1078	1450 litres
7.	Focke-Wulf I	1440 litres
8.	Blohm & Voss P.212	1370 litres

RATE OF CLIMB

Based on DVL process for performance calculations January 1945

1.	Messerschmitt P.1111	23.7m/s (4660ft/min)
2.	Focke-Wulf II	23.2m/s (4550ft/min)
3.	Junkers EF.128	22.9m/s (4500ft/min)
4.	Messerschmitt P.1101	22.2m/s (4380ft/min)
5.	Messerschmitt P.1110	21.5m/s (4250ft/min)
6.	Blohm and Voss P.212	21.3m/s (4200ft/min)
7.	Focke-Wulf I	20.5m/s (4020ft/min)
8.	Heinkel P.1078	data unavailable

MAXIMUM ARMAMENT

1.	Blohm & Voss P.212	5 x MK 108
2.	Messerschmitt P.1110	5 x MK 108
3.	Focke-Wulf I	4 x MK 108
4.	Junkers EF.128	4 x MK 108
5.	Messerschmitt P.1101	4 x MK 108
6.	Messerschmitt P.1111	4 x MK 108
7.	Focke-Wulf II	3 x MK 108
8.	Heinkel P.1078	2 x MK 108

TOP SPEED (any altitude)

Based on DVL process for performance calculations January 1945

1.	Messerschmitt P.1110	1000kph (621mph)
2.	Messerschmitt P.1111	995kph (618mph)
3.	Messerschmitt P.110	980kph (608.5mph)
4.	Blohm and Voss P.212	965kph (599mph)
5.	Focke-Wulf II	962kph (597mph)
6.	Focke-Wulf I	955kph (593mph)
7.	Junkers EF.128	905kph (562mph)
8.	Heinkel P.1078	data unavailable

TAKE-OFF WEIGHT

1.	Heinkel P.1078	3920kg
2.	Messerschmitt P.1101	4064kg
3.	Junkers EF.128	4077kg
4.	Focke-Wulf II	4100kg
5.	Blohm and Voss P.212	4180kg
6.	Messerschmitt P.1111	4282kg
7.	Messerschmitt P.1110	4290kg
8.	Focke-Wulf I	4379kg

THE EMERGENCY FIGHTER COMPETITION MYTH

During the late 1960s to early 1970s, historians began to discuss what they called the 'Emergency Fighter Competition'.

One typical example, published in 1972, noted under a heading of that name: "The OKL (High Command of the Luftwaffe) insisted that an improved fighter was urgently needed and, at the end of 1944, an Emergency Fighter Competition was instigated by Col Siegfried Kneymeyer [sic], Chief of Technical Air Armament (Chef/TLR).

"The specification issued to all the main aircraft companies required that the new fighter be powered by a single Heinkel-Hirth 109-011A turbojet, have a level speed of about 1000kph at 7000m, operate at altitudes up to 14,000m and be armed with four MK 108 30mm cannon.

"By February 1945, two projects had been received from Focke-Wulf, three from Messerschmitt, and one each from Heinkel, Junkers, and Blohm und Voss."

What is described here is the 1-TL-Jäger competition. The term 'Emergency Fighter Competition', commonly translated into German as the 'Jägernotprogramm', does not appear in any contemporary documents.

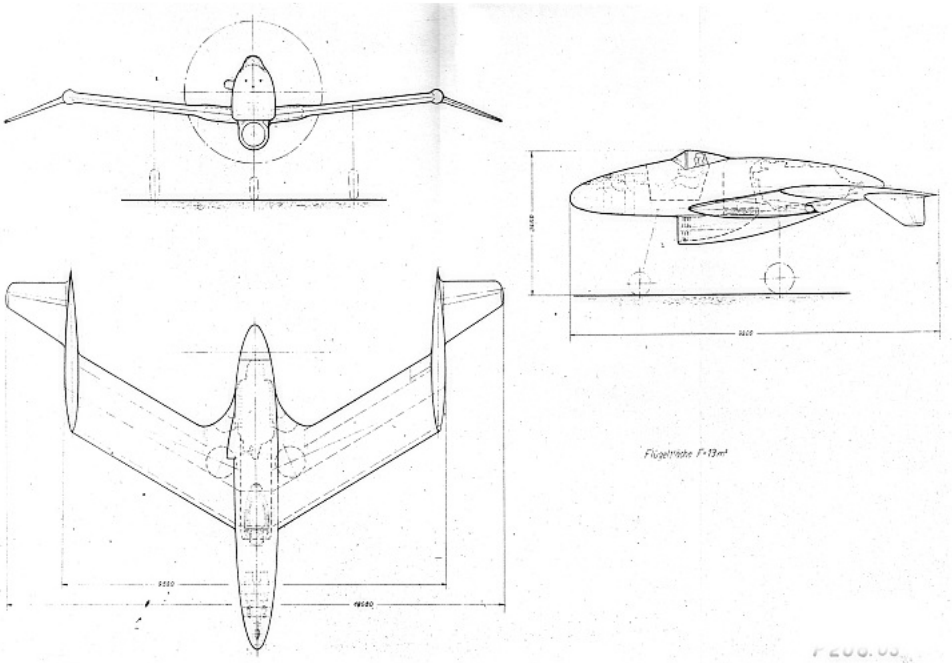
Yet seemingly by its emotive nature, the term has persisted and now regularly finds its way into modern publications. Indeed, some have expanded the 'competition's' scope to encompass every advanced project worked on by German aviation companies from mid-1944 onwards.

Books have been written under the title Emergency Fighter Competition and there are commonly disagreements about whether one aircraft or another fell within the aegis of the competition when, in reality, no such competition existed.

P.212

1-TL-Jäger – Blohm & Voss

The single-jet fighter design proposed by Blohm & Voss was so radical it immediately inspired scepticism and criticism from all quarters. As the contest progressed however, the P.212's opponents steadily began to see its novel features in a new light…



ABOVE: Almost the first bat-wing. The Blohm & Voss P.208 was to be powered by a DB 603L driving a propeller pushing the aircraft from behind. The wingtips were fitted with pronounced booms to which the control surfaces were attached. GDC

With a reputation for shipbuilding that was second to none it seemed only natural when, in 1933, Hamburg-based Blohm & Voss set up a new aviation subsidiary – Hamburger Flugzeugbau – that specialised in seaplanes, flying boats and maritime patrol aircraft.

Based in Hamburg's Finkenwaerder quarter, Blohm & Voss's aircraft designers had not had cause to work on a single-seat fighter until Messerschmitt's failing shipborne/high altitude fighter project, the Me 155, was handed to them in August 1943 by the RLM.

The overtaxed Messerschmitt design team had struggled to give any time to the Me 155, which was very loosely based on the Bf 109 and shared a handful of the same components, but Blohm & Voss was delighted to have the opportunity to be working on a prestigious single-seat fighter at last.

Where Messerschmitt had spent months scarcely paying lip-serve to the idea of working on the Me 155, Blohm & Voss very quickly redrafted Messerschmitt's ideas for the type and proceeded with a design that was largely of its own devising. Rapid progress was made, and by the time the 1-TL-Jäger competition was announced, the first prototype of what had now been redesignated the BV 155 was close to completion.

In the months that had followed the commencement of work on the Me/BV 155, the design office of the company, now renamed Blohm & Voss Flugzeugbau, led by chief designer Richard Vogt, drew up a series of designs for ground-attack aircraft – many of them incorporating mixed turbojet and piston engine propulsion – and single-seat jet fighters.

The first Blohm & Voss single-seat jet fighter, the P.197, had a relatively conventional layout but with advanced features such as swept wings and a T-tail. Next came the P.198, designed to fit around the enormous BMW 018 jet engine, which boasted a 12-stage axial compressor.

The P.202 was another jet fighter, this time with a highly unusual single piece wing which could be rotated to the left or right while the aircraft was in flight. The P.203 was a heavy fighter designed in June 1944 which used both a piston engine and a jet engine in each wing.

The design that seemed to hold the most promise, however, was the P.208. This tailless piston-engined pusher propeller fighter had the virtues of being lightweight, cheap to build, fast and agile – at least on paper. Its control surfaces took the form of downturned wingtips mounted at the end of booms attached to the ends of the main wings. These served simultaneously as elevators and rudders.

Without a jet engine, the P.208 was ineligible for the 1-TL-Jäger competition so Vogt's team quickly reworked it around a Heinkel HeS 011 powerplant as the P.209.01. Then changed their minds and created the quite different P.209.02. This was the design that simply wasn't ready in time for the initial presentation, but the completed brochure was quickly sent out to the other competitors and the RLM shortly thereafter.

On November 8, 1944, Blohm & Voss responded to a memo it had received from the EHK under the heading 'Why produce the Otto fighter?', in other words, what did the firm perceive to be the advantages and disadvantages of continuing to design and build new piston-engined aircraft at this stage in the war.

Its response took the form of a detailed comparison between four aircraft types it said it was working on simultaneously – the BV 155C "the extreme high-level fighter", the P.208.03 "Otto fighter with DB.603, pusher airscrew and outer tail unit", P.209.02 "TL fighter with HeS 011, with central inlet pipe connection and built-in engine" and the "midget fighter" P.211.01 "TL fighter with BMW 003, detailed projects for it having been worked out".

It stated: "Our own people having during the past months been very busy on plans for high-speed fighters on both lines of development – Otto as well as TL lines – and the projects having therefore reached an equal state of maturity, it seemed appropriate to

answer the above question by simply comparing the operational efficiency of both types."

In the comparison of speed, the Blohm & Voss report states: "At low altitudes the Otto fighter is inferior to both types of TL machines, midget as well as high-speed fighter. At its full pressure height level the Otto fighter is steadier than the midget fighter whose range hardly enables it to reach that altitude.

"At absolute maximum speed the midget fighter gains slightly while remaining somewhat below the full pressure height level of the Otto fighter. The extreme high-speed fighter with HeS 011 engine is much more efficient at all altitudes. The extreme high-level fighter built on Otto lines lacks speed when performing at altitudes which however as yet, it alone is able to attain."

Comparisons of climbing power, range and endurance, fuel efficiency, weapon carrying capability, acceleration and ease of production follow. While an overall conclusion is lacking, the report ends with: "However indispensable the Otto fighter in its further stages of development may prove to be, it is nevertheless advisable to reduce its production while simultaneously switching over to the production of TL fighters."

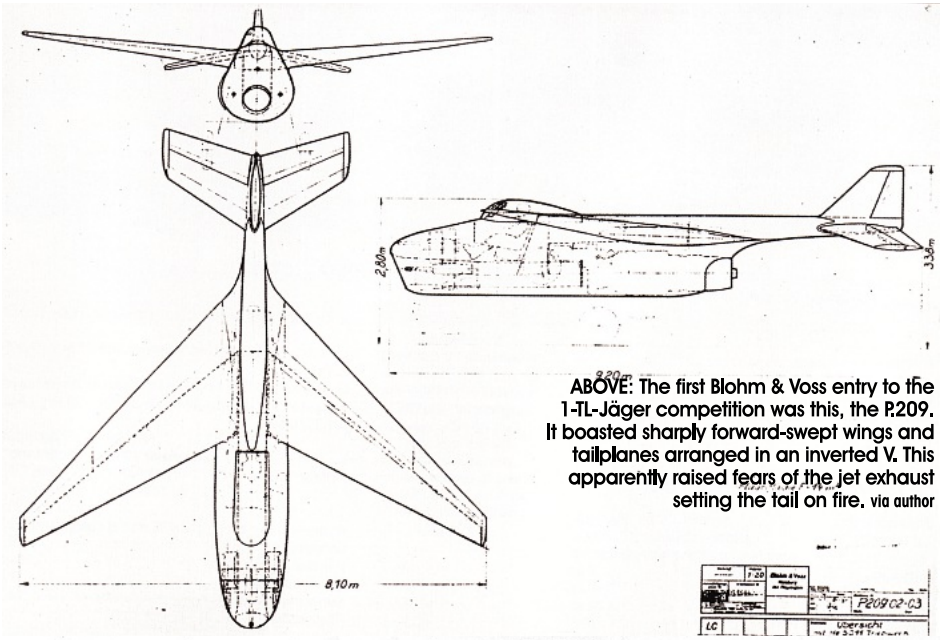
Meanwhile, the reaction of the recipients of the P.209 brochure, though the precise wording is unknown, can be inferred from the brochure for Blohn & Voss's updated proposal of November 28, 1944 – the P.212, more specifically the P.212.02.

This remarkable document proudly bears the title 'Fastest fighter with HeS 011 – P.212' and the subtitle 'tailless with edge control surfaces'.

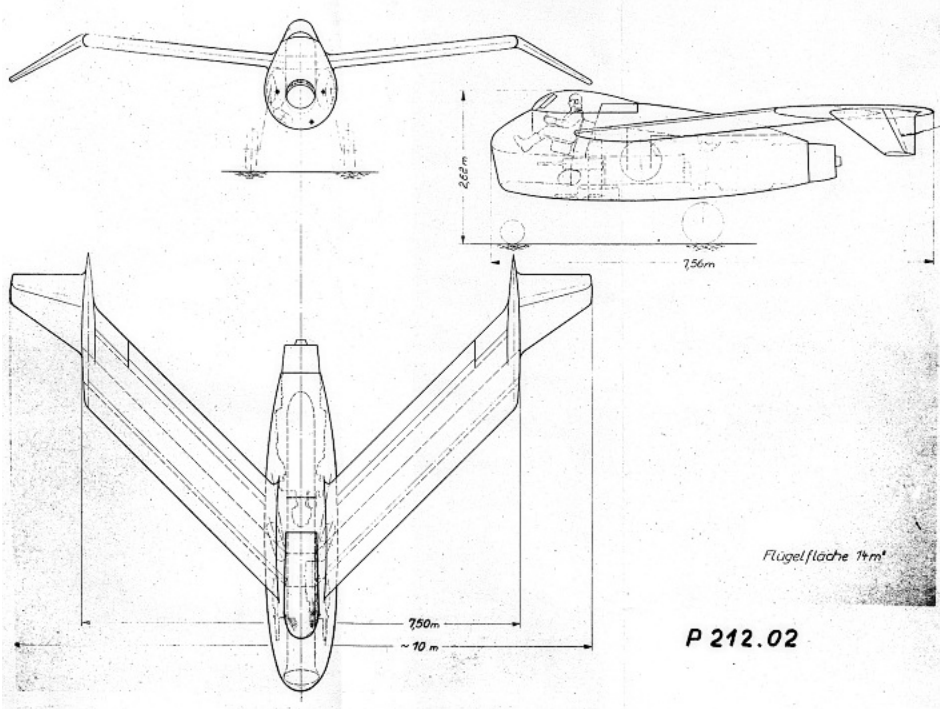
The first line of the first page gets straight to the point: "Compared to the P.209 project, the design described here shows a free outflow of engine gases that does not influence the stabiliser. This was achieved by the complete removal of the tail from the wing downwash."

On the P.209.02, the high-set wings were sharply swept forward but the control surfaces on the end of the boom tail made an inverted V – thereby posing problems in the event of manoeuvring causing jet wash to effect the rudder/elevators. In addition, judging from what is stated later on, it seems that concerns had been raised about the potential for the aircraft setting its own tail on fire.

The high-wing P.212 design prevented both problems by placing the control surfaces well away from any interference from jet wash.

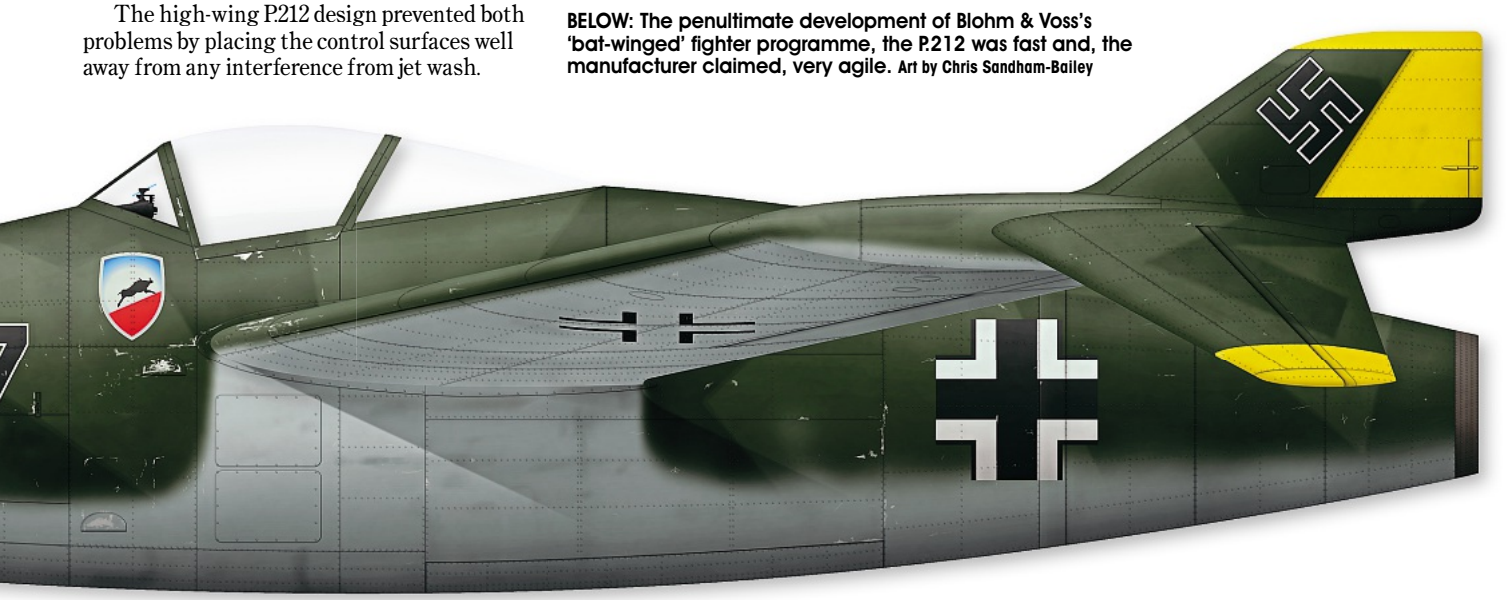


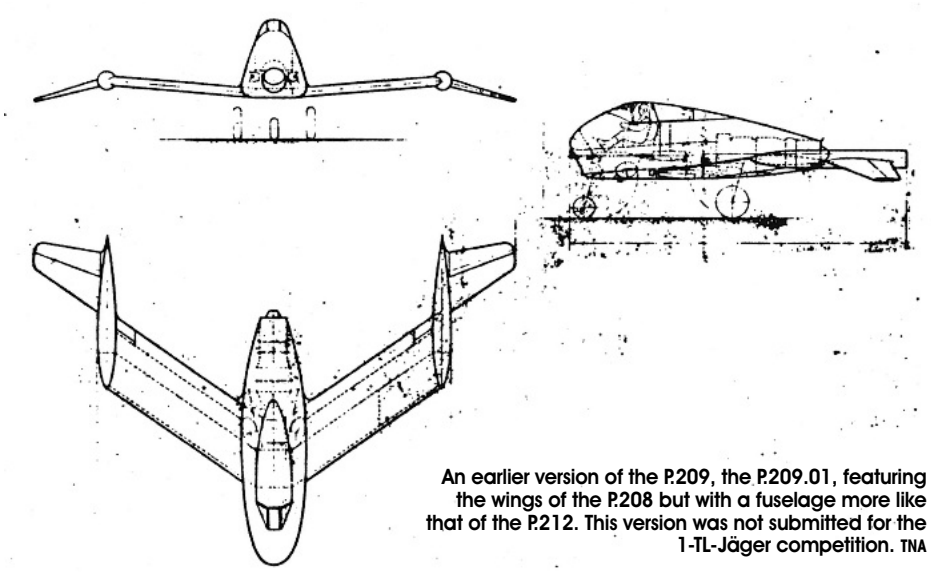
ABOVE: The first Blohm & Voss entry to the 1-TL-Jäger competition was this, the P.209. It boasted sharply forward-swept wings and tailplanes arranged in an inverted V. This apparently raised fears of the jet exhaust setting the tail on fire. via author



ABOVE: By November 1944, the P.209 had evolved into the P.212. The wingtip booms were reduced in size, the wings themselves were moved up to a shoulder position and the fuselage was reshaped to improve high-speed performance. GDC

BELOW: The penultimate development of Blohm & Voss's 'bat-winged' fighter programme, the P.212 was fast and, the manufacturer claimed, very agile. Art by Chris Sandham-Bailey





An earlier version of the P.209, the P.209.01, featuring the wings of the P.208 but with a fuselage more like that of the P.212. This version was not submitted for the 1-TL-Jäger competition. TNA

The brochure continues: "Incidentally, we had tried the same fuselage arrangement as that of the P.209 project. However, the performance of the new design resulted in such a considerable gain in speed – namely 35km on the ground and 45km in 6000m altitude – that it was necessary to increase the sweep of the wing to 45 degrees.

"This high sweep pushed the wing joint on the fuselage so far forward that a rearrangement of the cockpit and armament was required. The high sweep brings an increase in the flight weight but on the other hand it means that the tail booms can be reduced to insignificant stumps without affecting the effectiveness of the control surfaces.

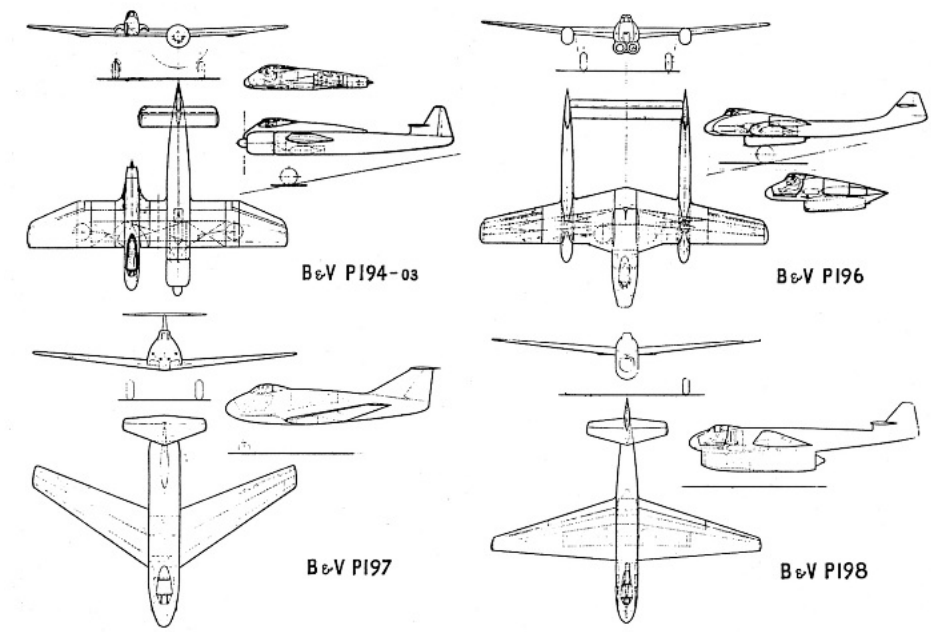
"With regard to the production expense, everything that was said in the brief description of the P.209 project remains true. It is therefore advisable to consult them simultaneously. In summary it can be said that the technical benefits of the P.212 project against P.209 are both in the operational and performance areas.

"Operational – in order to avoid the consequences of an outlet-fire – an unobstructed gaseous effluent always desirable. Performance-wise, the big speed gain is considered particularly important. With a 1030km maximum speed the new project should be placed at the top of any comparison of projects with the same engine."

The P.212's wings, to be made as a single unit, were also to be "constructed as a steel shell" that could hold 750 litres of fuel.

As with other Blohm & Voss designs of the period, the jet engine's inlet pipe was to act as the main structural support for the whole aircraft. The brochure states: "Again, the TL inlet pipe is the inner support of the fuselage. On it all the control operations, the weapons, the instruments and the equipment are installed and so the installation of all these is completely accessible [for maintenance].

"Given the large size of the inlet pipe required for the engine, even without special bracing and with thin wall thickness, it is of sufficient strength."



ABOVE: The design office at Blohm & Voss was highly prolific – turning out numerous designs as the war progressed. The P.197 was probably the company's first true single-seat fighter and went for broke with swept wings, a T-tail, internal engine and chin intakes. The design that followed, the P.198, was far less radical but had to accommodate an enormous BMW jet engine. TNA

Regarding the two main landing gear wheels: "The main landing gear is mounted on the fuselage boom and swings in forwards. The angle required for the retraction strut is favourable so only small pull forces or low hydraulic pressures are required.

"Extending the gear into the flight wind is done automatically, so it is particularly reliable. The nose wheel swings back at an angle to the fuselage. The bearing of the spring strut and retracting mechanism is carried on the fuselage pylon."

And regarding the engine: "The installation of the device is possible without a crane; the bodywork panels simply need to be folded away from it by the ground personnel."

Another 550 litres of fuel was to be contained in a fuselage tank – for an overall total of 1300 litres. The wing tanks would be drained first, followed automatically by the fuselage tank.

The aircraft's three MK 108 30mm cannon would be fitted around the jet inlet pipe, with the ammunition boxes, each containing 70 shells, positioned above them and behind the pilot.

By January 1945, Blohm & Voss had developed the P.212 to what would be its final form – the P.212.03. It is briefly described in the notes prepared in advance of the EHK's end of February meeting. A pressure cabin is a new feature and standard armament has been reduced to just two MK 108s but with a variety of options to increase it: "General: Tailless mid-wing plane with swept back wings and controls at the end of the wings. Wings: Steel skin wings in the Blohm and Voss type of construction can be constructed whole or in parts. Part of the inside of the wings built to hold fuel. Very deep landing flaps at the trailing edge, and nose flaps which slide into the wing leading edge.

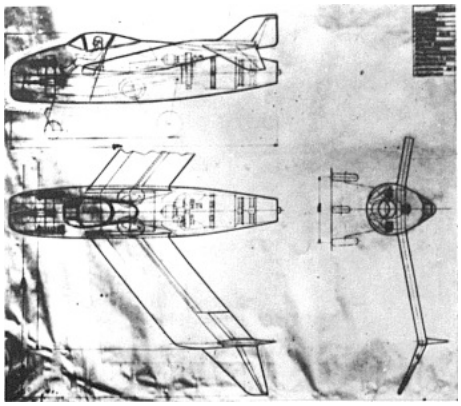
"Fuselage: The curved steel TL duct is the inside support of the fuselage. Just in front of the TL inlet the support pipe broadens out to attach to a longitudinal beam, each side of which is attached to the wing in front and the TL behind. The guns are placed in front of the pressure proof pilot's cabin, which is situated above the inlet pipe. The engine is in the stern.

"Stabilisers: At the end of each wing are two surfaces, of which, one slanting downward fulfils the function of the elevator and partly the functions of the vertical stabiliser and ailerons. The second fin is an additional small vertical stabiliser. In addition there is a small normal aileron.

"Undercarriage: Main undercarriage rests on the fuselage beams and moves forward into the fuselage. The nose wheel likewise moves forward. Main 710mm x 185mm, nose wheel 465mm x 165mm.

"Engine: The HeS 011 engine is fixed to the fuselage. Air is introduced through bent inlet pipe in the tip of the fuselage. Fuel installations: 820 litre unprotected and 150 litre protected in the wings behind the pilot, and in front of the turbo a well-constructed protected tank of 480 litres. Additional tank in wings to make a total of 1370 litres. Equipment: Standard equipment for fighter aircraft.

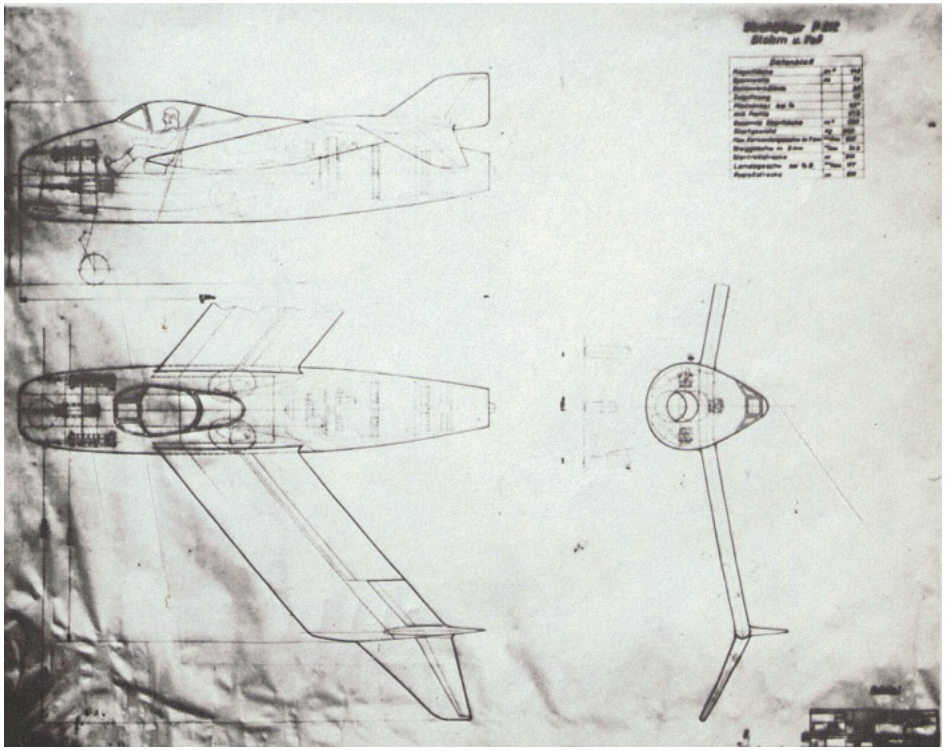
"Armament: 2 x MK 108 with 100 rounds each next to the air duct in the fuselage nose. An additional MK 108 possible above the duct. Further additional 2 x MK 108 with 60 rounds each provided behind the pilot in the under part of the fuselage. Possible armament



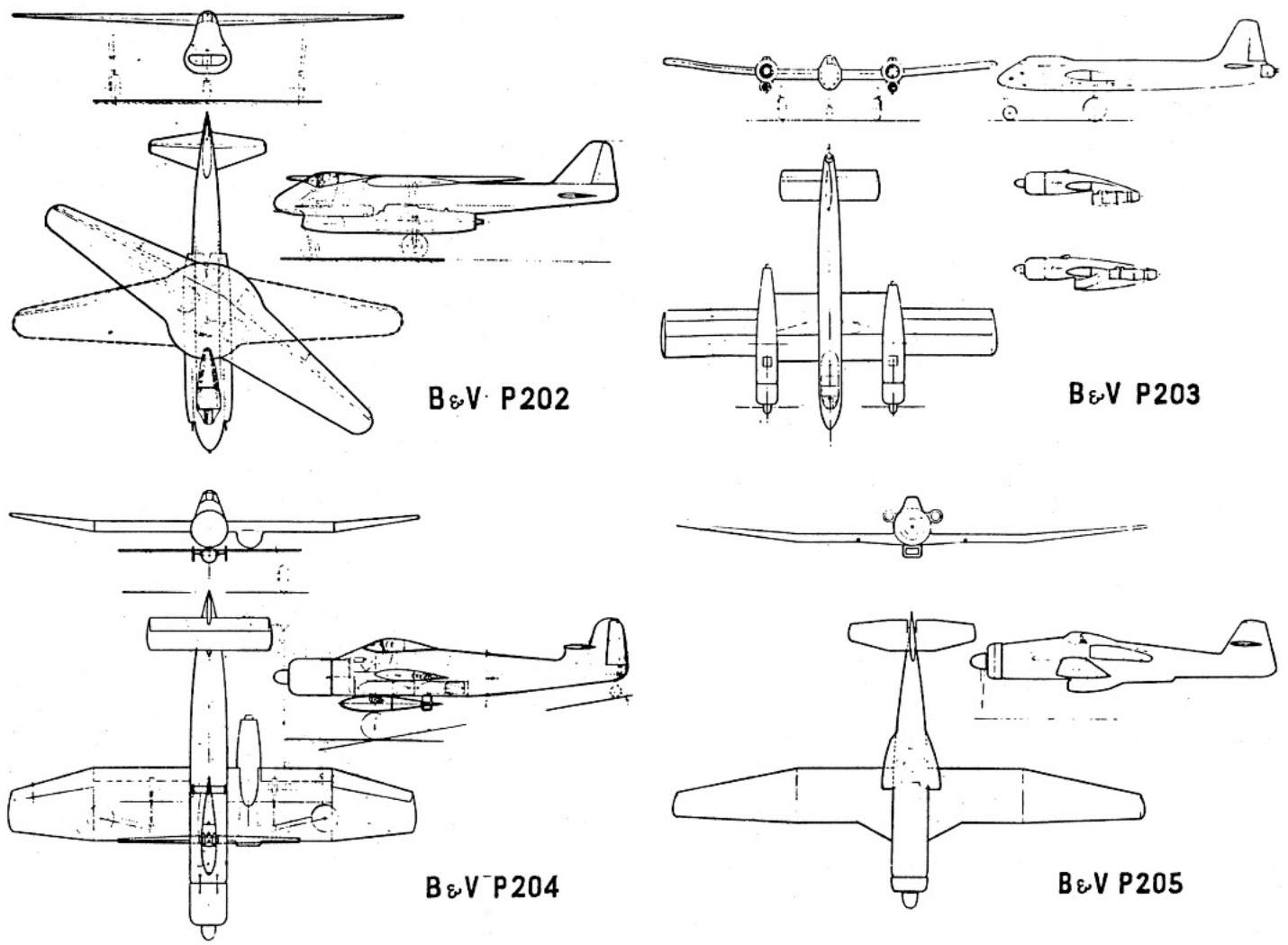
ABOVE: This low quality image shows the final development of the P.212 – with the wingtip booms now entirely gone and small fins added, and the fuselage reshaped once more. TNA

variation with MG 103 and MK 112. Possible to build a place in the fuselage for 500kg bomb. Bullet-proofing: The pilot is protected from shots back and front by armour."

Despite its innovative design and potentially heavy armament of five MK 108 30mm cannon, the P.212 was not chosen to be the recipient of a development contract. Its fundamental design principles would live on a little longer, however, in the P.215. ●



ABOVE: A second reproduction of the same final version P.212 drawing, showing different details from the first. Note the gentle curve of the rear section of the cockpit canopy – a detail lost in most modern reproductions of the design. TNA

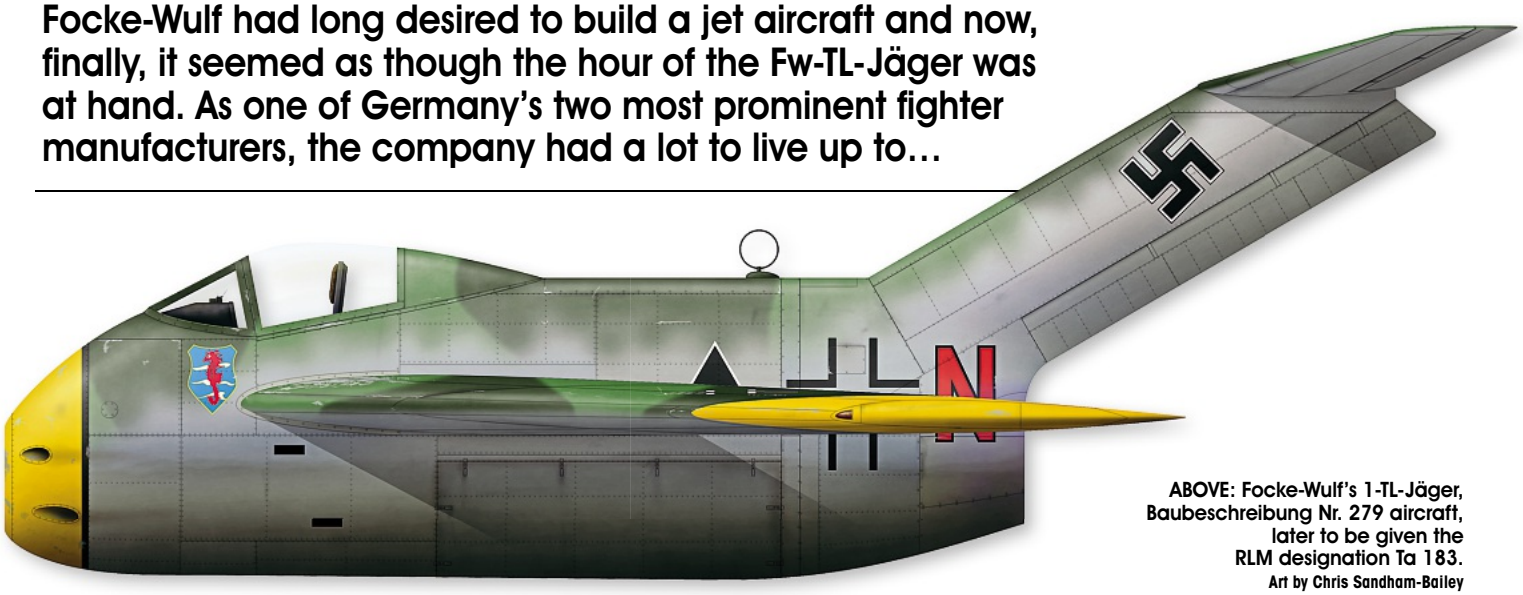


ABOVE: Blohm & Voss had spent much of the war designing transport, observation and ground-attack aircraft, but as 1944 wore on it concentrated increasingly on single-seat fighters. The P.202 boasted a radical moving wing, the P.203 had both piston engines and jets (the engine pods would have been symmetrical – they are shown different lengths here for comparison), and the P.205 was the most advanced version of what had been the Me 155. TNA

I and II

1-TL-Jäger – Focke-Wulf

Focke-Wulf had long desired to build a jet aircraft and now, finally, it seemed as though the hour of the Fw-TL-Jäger was at hand. As one of Germany's two most prominent fighter manufacturers, the company had a lot to live up to…



ABOVE: Focke-Wulf's 1-TL-Jäger, Baubeschreibung Nr. 279 aircraft, later to be given the RLM designation Ta 183.
Art by Chris Sandham-Bailey

When Messerschmitt defeated Focke-Wulf in a competition to design the Luftwaffe's mainstay front line fighter in 1936, the Bremen company went back to the drawing board.

And while the Bf 109 was being battle-tested and developed on the front line during the Spanish Civil War, Focke-Wulf was developing what would become the earliest prototype of the Fw 190.

This first flew in June 1939, by which time the Bf 109E had already been in service for more than six months. So while Messerschmitt was working on its next major fighter – the Me 262 – Focke-Wulf was devoting all its efforts to bringing the Fw 190 and its troublesome BMW 801 piston engine into service.

It was not until the spring of 1942, with the Fw 190's future assured and with money rolling in from huge government orders, that Focke-Wulf turned its attention to developing the aircraft's successor.

Interviewed after the war, Focke-Wulf engineer Dr Otto Pabst told his British captors that, like Heinkel, Focke-Wulf had attempted to design its own jet engine.

The report states: "Prior to the war, Dr Pabst had also worked on a gas turbine engine to be constructed by Focke-Wulf, which consisted of a double entry radial compressor and a single stage axial flow turbine with a single annular burner chamber which was expected to produce 600kg thrust at 11km or 2kg thrust at sea level.

"This power plant was being considered for the Fw 200 (four engine bomber of the B-17 type)."

Unlike Heinkel, Focke-Wulf was not successful and abandoned its ambition to design a jet engine in-house.

Much of the effort made in 1942 was aimed at creating a successor to the Fw 190 by replacing its perpetually overheating original powerplant with one of the multitude of advanced and promising piston engines then being worked on particularly by Daimler-Benz and BMW – and fitting a suitable new Fw 190-like airframe around it.

These included the supercharged BMW 801J and BMW P 8028, the heavy but powerful DB 614, the twin-supercharged DB 213A, the DB 609 which required massive radiators to be fitted to either side of the airframe and BMW's hugely long P 8011 driving contra-rotating propellers.

Among the many different engines looked at was a simple turbojet design of Focke-Wulf's own devising, different to that earlier envisaged, which could effectively be bolted onto the front of the standard Fw 190 fuselage. The device had an annular thrust nozzle – which meant it exhausted down the sides of the fuselage and underneath it, though not over the pilot's canopy.

This was expected to produce a top speed of 516mph, which was less than that projected for the Me 262 and He 280. Although it had the advantage of being able to use factory fresh Fw 190 airframes with very little modification, it was little more than a stopgap and the RLM believed that other projects held more promise.

At the same time there was another engine being worked on which could not possibly have been accommodated within an airframe like that of the Fw 190 – the BMW 803. This monstrous 28-cylinder, four-row, 83.6 litre liquid-cooled radial engine was essentially a pair of BMW 801s mounted back to back and driving two contra-rotating propellers.

One engine drove one propeller directly, while the other drove a number of smaller shafts threaded between the cylinders of the other engine which then drove the other propeller via a large gearbox.

It produced a whopping 3847hp, compared to, for example, the 1820hp produced by the Spitfire XIV's Rolls-Royce Griffon 61. All the parts required to make it work, though, made the BMW 803 extremely heavy. On its own, without the rest of any aircraft it might be attached to, it weighed 9086lb fully loaded – more than the maximum takeoff weight of a Spitfire XIV in its entirety.

Casting around for an airframe that might house this behemoth, Focke-Wulf's engineers began to consider the twin boom design of the Fw 189 Uhu reconnaissance aircraft. A whole range of studies were then carried out during early 1943 on the potential of the twin boom layout to house a large and unwieldy powerplant.

At the end of 1942, a young self-taught aerodynamicist working in the Focke-Wulf design department, Julius C Rotta, was asked to undertake a wide-ranging 'blank sheet' study looking at what sort of airframe might be best suited to housing a single turbojet powerplant and what sort of performance could be expected from it.

THE FIRST SINGLE JET DESIGNS

His report, Fundamentals For The Design of a Jet Fighter, was published on January 4, 1943, and looked at how large a jet fighter ought to be, what sort of shape and layout would be best, what jet engines could be fitted and how, what the advantages and disadvantages of piston engines and jet engines were and aerodynamic issues.

To illustrate his points, Rotta came up with a trio of remarkably foresighted designs: Jäger mit Turbinentriebwerk BMW P3302 Design 1, Jäger mit Turbinentriebwerk BMW P3302 Design 2, and Jäger mit Turbinentriebwerk Junkers 109 004.

All three had the jet engine mounted on their backs, just as the Heinkel He 162 would be configured 20 months later. The first and third designs also had forward-swept wings and backwards swept V-tails. The second BMW P3302 design had unswept wings and an unswept V-tail.

Rotta wrote: "There will now be described the draft of a fighter with the BMW P3302. The design has the advantage that optionally also the Junkers 109 004 engine can be installed without major changes to the airframe.

"General structure – since the proportion by weight of the engine on the flying weight is quite large, the engine must not be very far away from the centre of the aircraft. This fact and the large size of the engine mean basic aspects of the aircraft's layout come into consideration.

"Engine above or below the hull, engine on the wing next to the fuselage (unbalanced design), engine within the fuselage of the aircraft or an arrangement of two hulls to accommodate pilots and fuel.

"The latter version is ruled out because with such a small wing caused by three hulls, disturbance of lift distribution creates intolerable conditions. The same also applies for the mentioned asymmetrical design."

He then concludes that the undercarriage must retract into the fuselage, rather than the wings, for reasons of weight distribution – precluding the fitting of a jet engine into or under the fuselage, he says, and also ruling out the asymmetrical design.

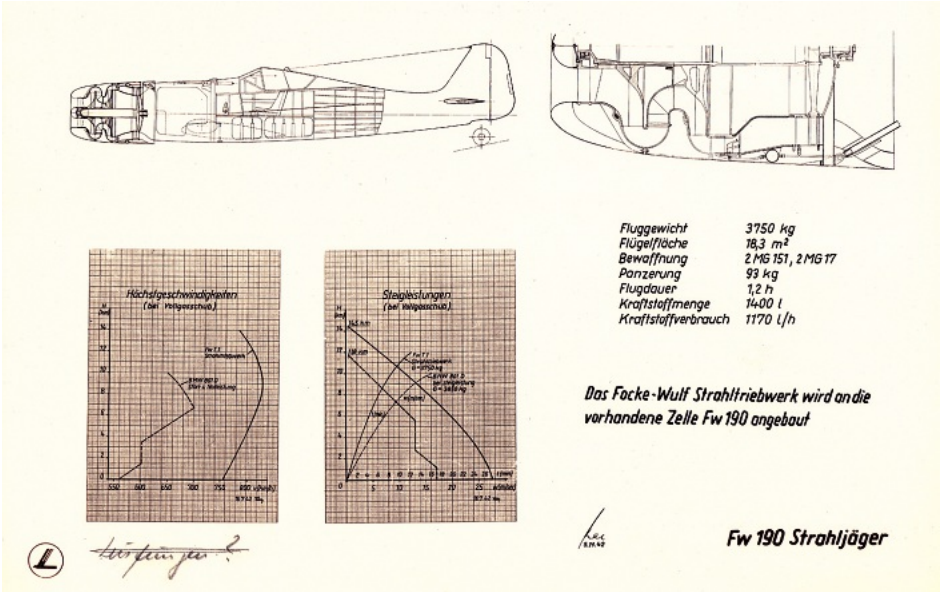
"So the only remaining solution is the arrangement of the engine above the fuselage. A suggested armament would be 2 x MK 108 with 200 rounds and 2 x MG 151 with 300 rounds.

"The fuel quantity is 850 litres. The landing gear is retracted into the hull, so that the two wheels of the main landing gear are located one behind the other.

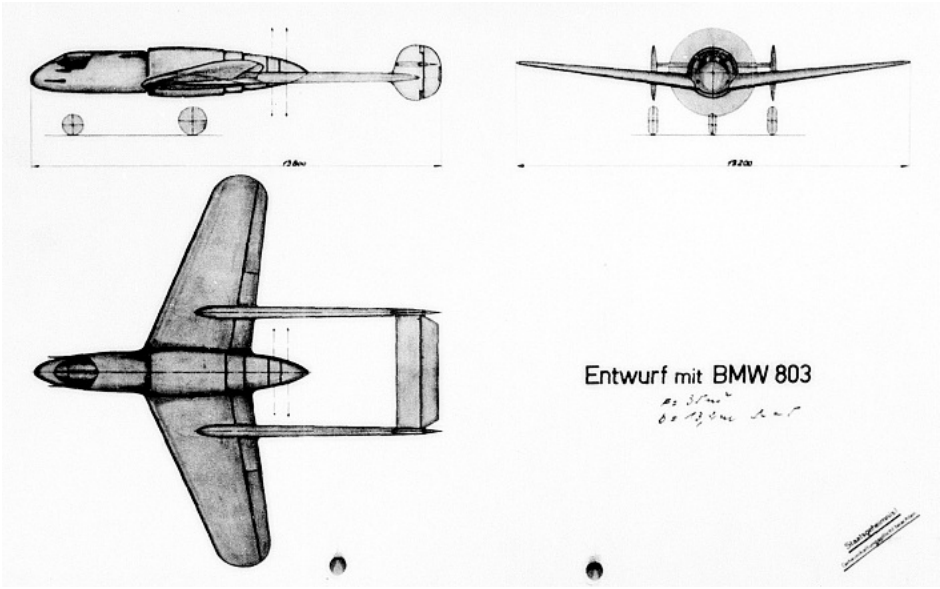
"For aerodynamic reasons, a very strong wing sweep was provided to the front. An alternative suggestion of design has also been made without an arrow shape of the wing."

Apparently there was some concern at this time about the hot gases exhausting from jet engines because Rotta writes: "The heating by exhaust plume of the parts behind the engine is safe and is in no case more than 100°C, as can be seen with reference to a chart image supplied by BMW of the temperature distribution in the beam.

"The installation of the Junkers engine 109 004 in the same airframe is also shown. Since both the electrical connections and operating terminals are provided on the upper side of the engine, in accordance with an arrangement of it being fitted under a wing, a pivoting of the engine by 180 is required for the present case.



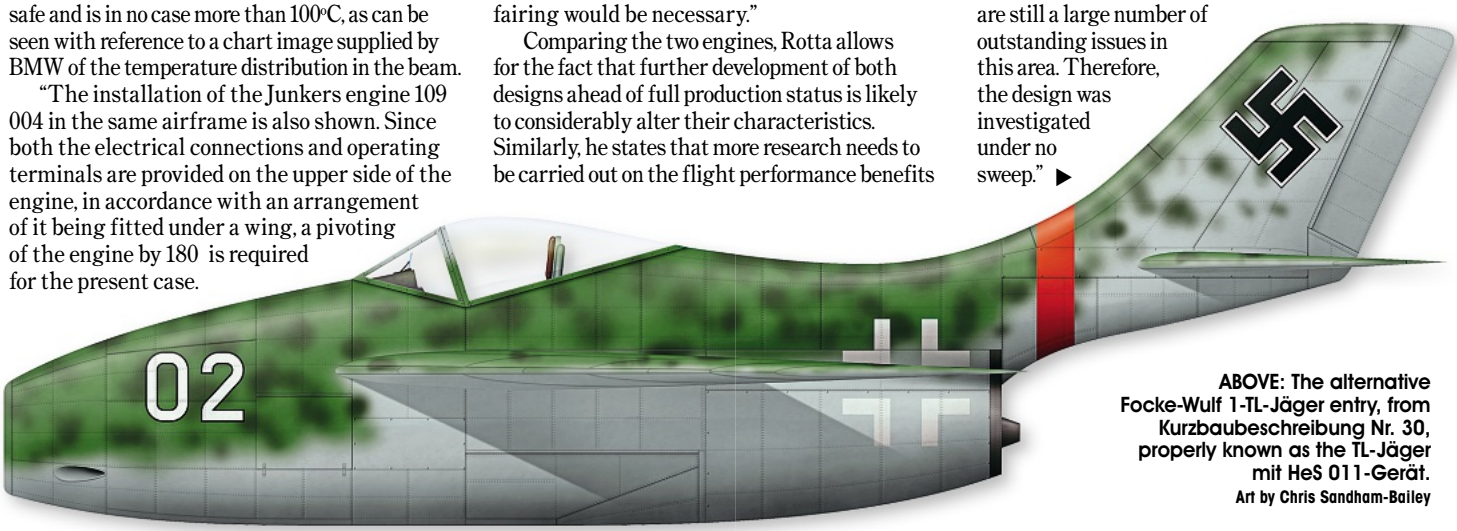
ABOVE: The earliest known attempt to create a Focke-Wulf jet fighter was this design, dated November 5, 1942, but probably worked on much earlier. It was largely a standard Fw 190 airframe with an in-house turbojet bolted on in place of the usual BMW 801 piston engine. GDC



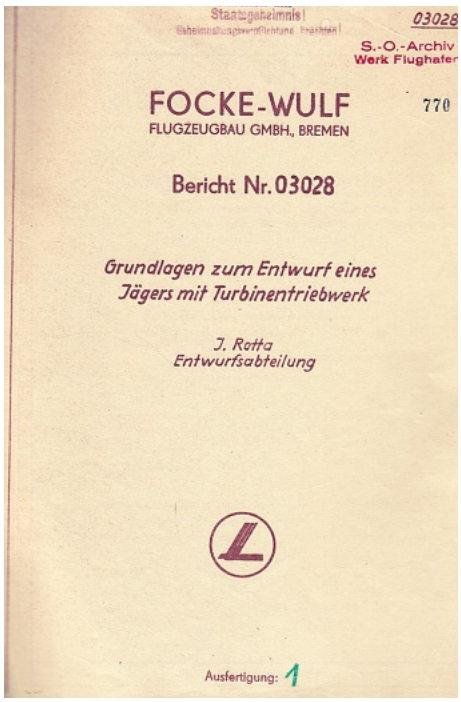
ABOVE: During an extensive study to find a new engine for future fighters, Focke-Wulf worked on ways of fitting the enormous BMW 803 into a fighter. The only layout capacious enough to accommodate it was a twin-boom design based on the Fw 189 Uhu reconnaissance aircraft. While the BMW 803 engined fighter went nowhere, Focke-Wulf came increasingly to regard the twin-boom layout it had devised as the ideal form for a new jet fighter. via Scott Lowther

"The integrated oil system would have to be rebuilt. In the airframe, no changes other than minor modifications to the fuselage fairing would be necessary."

Comparing the two engines, Rotta allows for the fact that further development of both designs ahead of full production status is likely to considerably alter their characteristics. Similarly, he states that more research needs to be carried out on the flight performance benefits of forward-swept wings: "How far the theoretically expected improvement occurs practically in the presence of the fuselage cannot be said. There are still a large number of outstanding issues in this area. Therefore, the design was investigated under no sweep." ▶



ABOVE: The alternative Focke-Wulf 1-TL-Jäger entry, from Kurzbaubeschreibung Nr. 30, properly known as the TL-Jäger mit HeS 011-Gerät.
Art by Chris Sandham-Bailey


Staatsgeheimnis! 03028
S.-O.-Archiv
Werk Flughafen

FOCKE-WULF 770
FLUGZEUGBAU GMBH, BREMEN

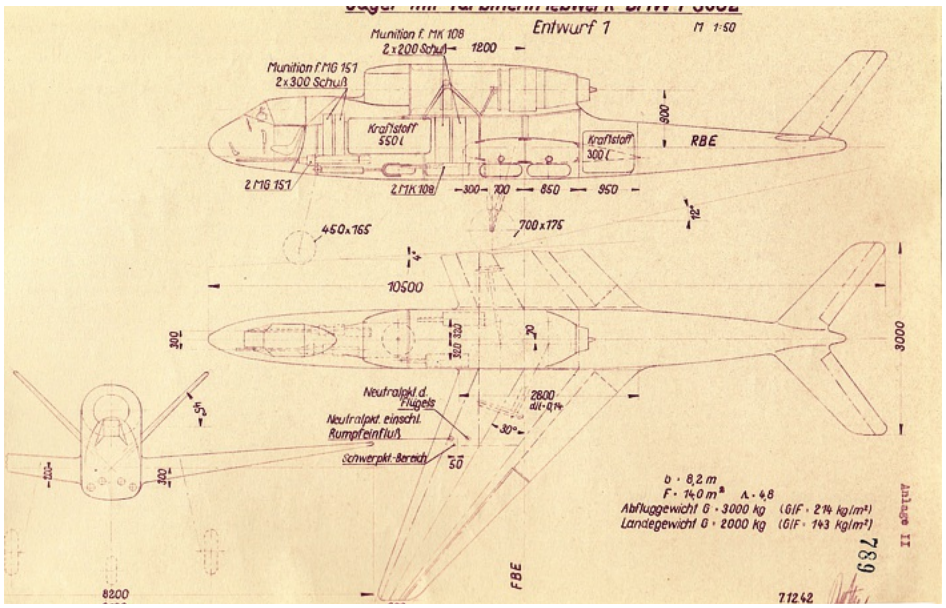
Bericht Nr. 03028

Grundlagen zum Entwurf eines Jägers mit Turbinentriebwerk

J. Rotta
Entwurfsabteilung

Ausfertigung: 1

ABOVE: Focke-Wulf aerodynamicist Julius C Rotta was tasked, at the end of 1942, with assessing all available data on jet engines likely to become available in the near future and working out what sort of aircraft layout would suit them best. His report, Fundamentals For The Design of a Jet Fighter, was published on January 4, 1943, and featured remarkable insights into the future of aircraft design. GDC



ABOVE: The first of Julia Rotta's designs for a potential future jet fighter was called Jäger mit Turbinentriebwerk BMW P3302 Design 1. It features radical aerodynamic features such as forward-swept wings and a V-tail. GDC

THE SEVEN PROJECTS

For reasons that are unclear, Focke-Wulf's design office then apparently embarked on a series of single-seat single-engine jet fighter designs at owed little or nothing to the conclusions reached by Rotta.

Much of what is known about these designs comes from a Focke-Wulf report published on August 15, 1944, in support of the company's first entry in the 1-TL-Jäger competition. It is entitled Considerations for Designing a Single-Engine Fighter Aircraft with Turbojet and is primarily concerned with arguing how and why the Focke-Wulf entry is superior in every respect to the Me 262.

Towards the back, to demonstrate how much effort has gone into the Focke-Wulf entry, it simplifies 18 months of complex work across numerous different designs, many of them worked on concurrently, into seven clearly defined and easy to understand projects.

Rather than use their somewhat lengthy and convoluted internal Focke-Wulf company designations, for the reader's benefit the August 15 report arbitrarily labels them '1. Design', '2. Design' and so on up to '7. Design'. For 70 years, this has caused considerable confusion among historians – since the true names of some of them are actually known – but has also served to provide easy terms of reference for those designs where they are not.

The '1. Design' was a tail-sitter clearly based, once again, on the Fw 190 but with the cockpit relocated to the nose in place of the familiar BMW 801 piston engine, and with the turbojet positioned directly below.

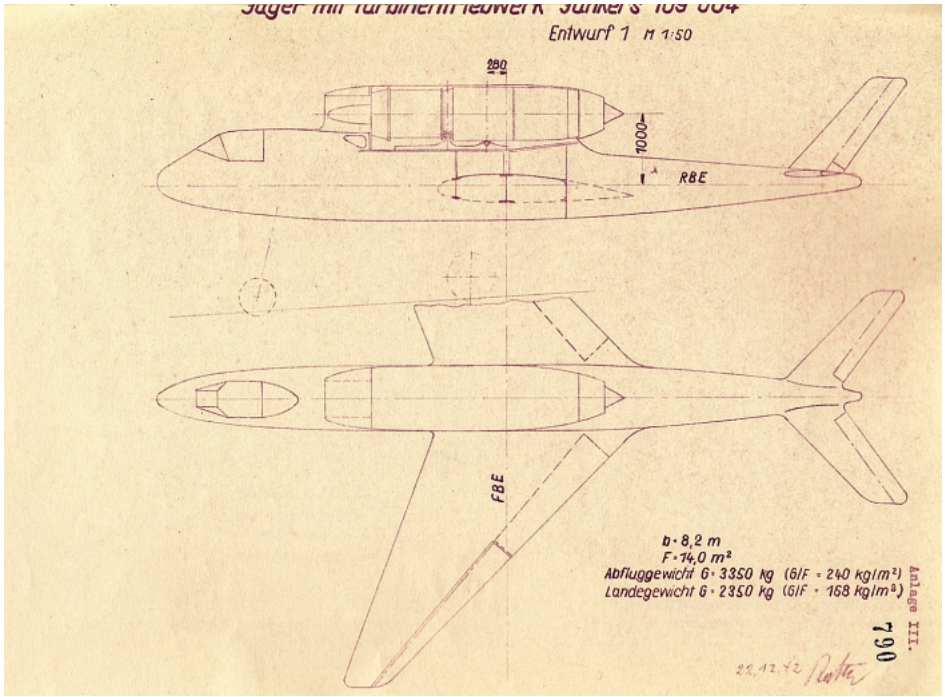
This put the engine very close to the ground and the August 15, 1944, report comments: "1. Design March 1943: With this arrangement, no satisfactory rolling properties were to be expected and there was also the risk of burning the airfield surface. This design was abandoned."

Little else is known about the '1. Design' – no original drawings have been discovered and its official Focke-Wulf name is unknown.

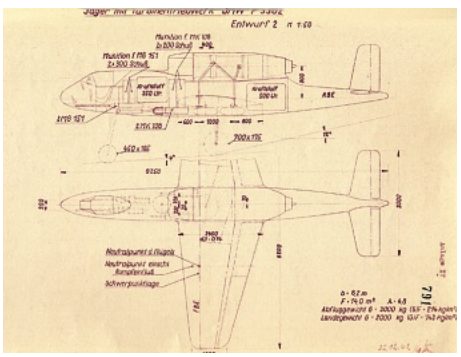
Focke-Wulf '2. Design' of June 1943 is much better documented since a full project outline was published in Focke-Wulf Baubeschreibung Nr. 264 Jäger mit Junkers-Turbinentriebwerk and this has survived. The aircraft retained its under-fuselage jet engine but this time had a nosewheel to prevent its exhaust from damaging the runway. The tail and wings resembled those of the Fw 190 but the cockpit, still positioned in the nose, was more refined.

The brief history of Fw jet designs states that the design was "rejected because of the risk of engine damage during belly landings".

For the '3. Design' of November 1943, the wings, cockpit and tricycle landing gear were kept but everything else was binned. The jet engine was now positioned within the upper



ABOVE: How Rotta envisioned his fighter design with a Junkers 004 engine. It was formally entitled Jäger mit Turbinentriebwerk Junkers 109 004 Design 1. GDC



ABOVE: Rotta's prescient second Jäger mit Turbinentriebwerk BMW P3302 design features straight wings for simplicity's sake. GDC

part of the fuselage, with the rear fuselage being thinned out and the tail split to allow for the jet exhaust. Keeping the rounded nose design, however, meant intakes for the jet engine had to be positioned either side of the cockpit.

As the report notes: "The third draft satisfied in terms of rolling characteristics and behaviour in belly landings. The calculated flight performance was inadequate due to the lateral intakes."

A radical shift now took place. The bulky twin-boom Fw 189-related fuselage designed for the BMW 803-powered fighter made a comeback in '4. Design' of December 1943 in order to accommodate a pair of rocket engines intended to improve the fighter's rate of climb. However, the report curtly states: "The horizontal velocity remained unsatisfactory."

It seems that '5. Design' and '6. Design' were worked on at the same time, though they are dated January 1944 and February 1944 respectively. For the '5. Design', a swept-wing T-tail fighter with a nose intake for its centrally positioned turbojet and tricycle undercarriage, the report explains: "In the fifth draft an attempt was made to raise the critical Mach number by particularly strong wing sweep.

"Extreme restriction in size made it possible to keep the entire surface approximately equal to that of '4. Design'." Perhaps foreshadowing a nickname the evolved design was later to acquire, it is stated that: "Experiments with a free-flying model raised concerns about the expected flight characteristics."

After five failures, the document suggests, the ultimate version of Focke-Wulf's fighter powered by a single HeS 011 turbojet is '6. Design' (the aircraft described in Baubeschreibung Nr. 280) – another twin-boom design but with a rocket engine to boost performance during a climb. This is the type that the whole document was written in support of, the report stating that "the intakes of the jet unit are positioned in the inner wing leading edge. Objections to this intake port design can be refuted by test measurements and wind tunnel tests".

The '7. Design' of July 1944 is essentially the previous design but fitted with a Daimler-Benz turboprop or 'PTL-Gerätes 021', derived from the HeS 011. The report boasts: "Due to the existing large overall thrust of the propeller-device, even at low speeds, it is possible to start on small frontline airfields without rocket drive.

"The speed and climb performance are such that no aircraft with a petrol engine is even close to being able to fight this fighter effectively."

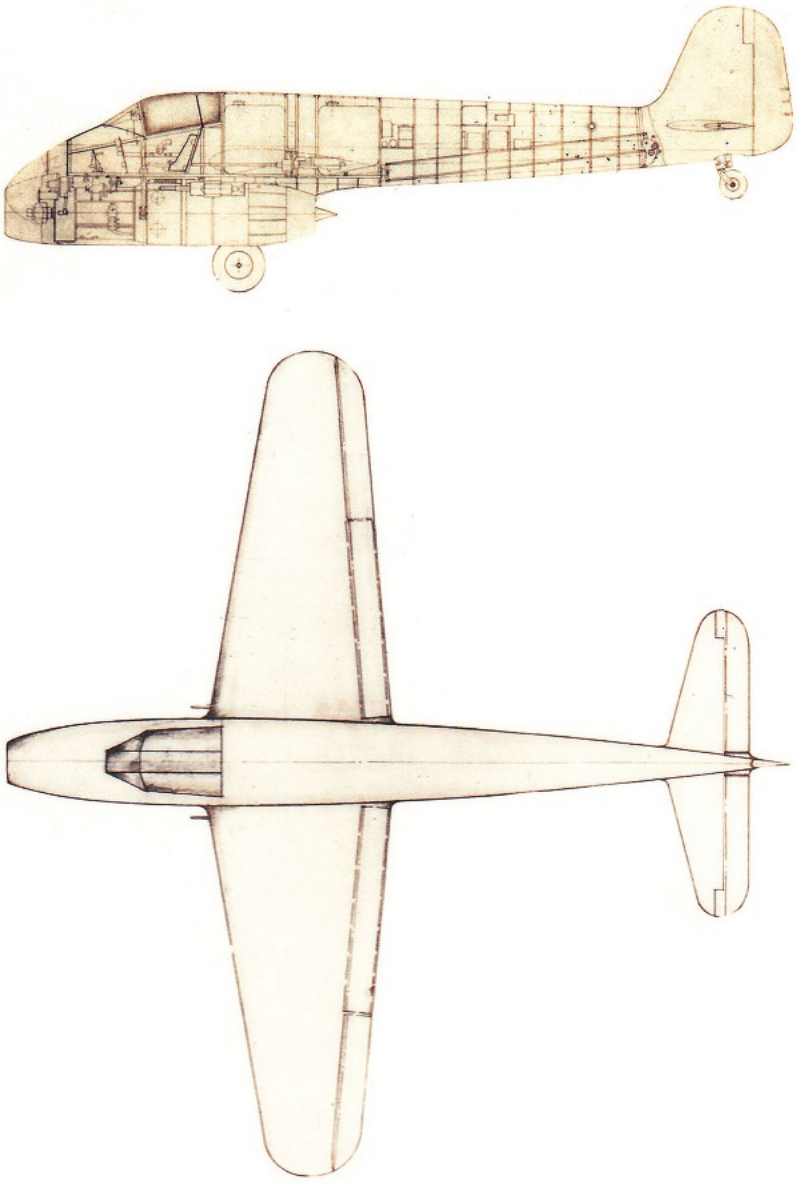
Little or no interest appears to have been shown in this type.

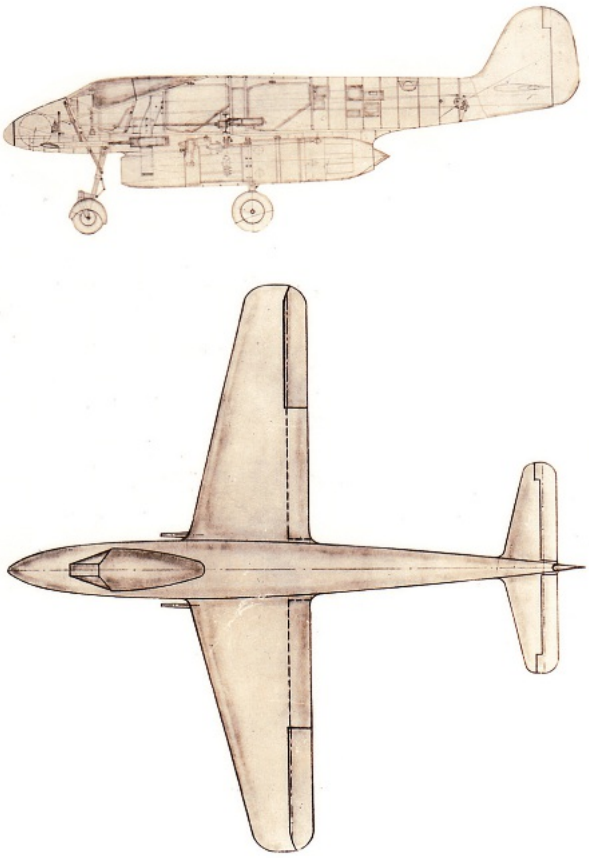
FW-TL-JÄGER (FIRST TRY)

Baubeschreibung Nr. 280 describes Focke-Wulf's first entry in the 1-TL-Jäger competition. According to the official Focke-Wulf chronology, the design was ready in February 1944 – six months before the contest was announced.

It consisted of a twin-boom machine with the HeS 011 jet engine mounted in the central fuselage above a Walter 109-509 rocket engine. It had a pressure cabin and hydraulically retractable landing gear. Armament was variable but there were two gun positions in the nose and another two in the wings. An October 1944 drawing shows MK 108 cannon in the wings and MK 103s in the nose.

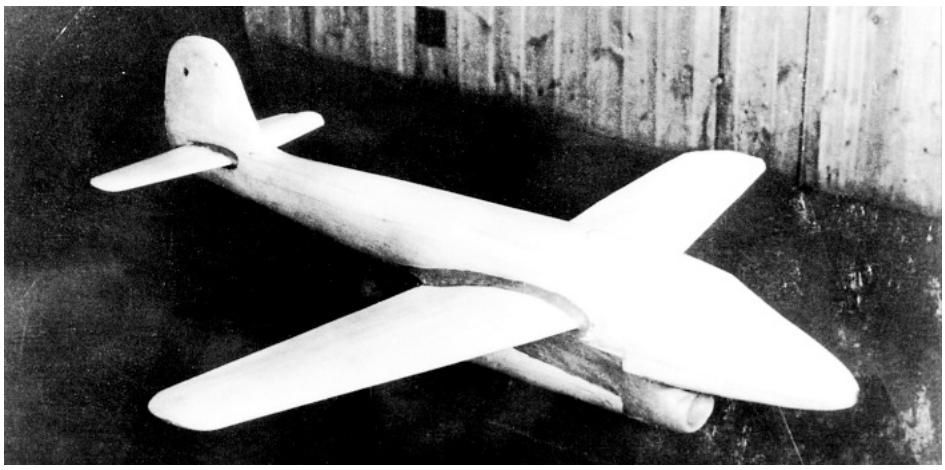
Focke-Wulf did draft a proposal based on this rocket-assisted twin-boom fighter shortly after it was completed but it seems as though this, outlined in Baubeschreibung Nr. 272, was not formally submitted to the RLM. ▶

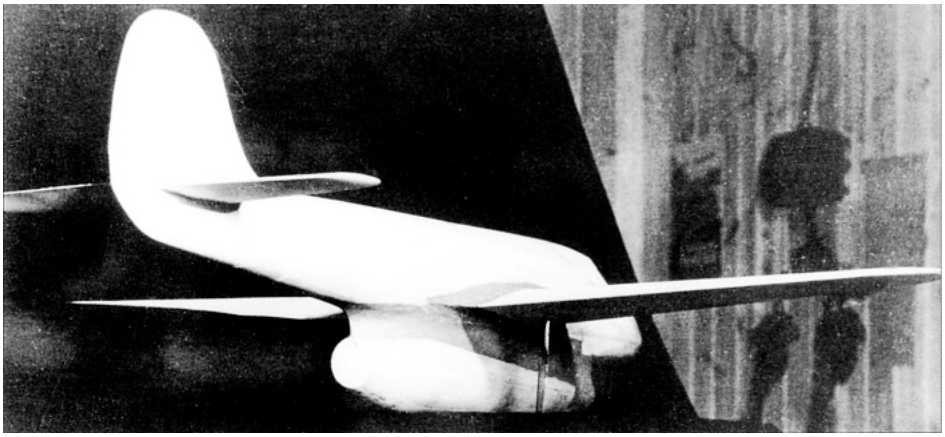




ABOVE: More is known about Focke-Wulf's next jet fighter effort. This June 1943 design is described in Baubeschreibung Nr. 264 and is called Jäger mit Junkers-Turbinentriebwerk. According to Focke-Wulf's own report it was rejected because its engine was at risk during belly landings. GDC

LEFT: Despite all having spent time and money on researching the ideal layout for a jet fighter, Focke-Wulf went ahead and designed this in March 1943. Its correct name is unknown but it is commonly referred to as 'Projekt 1', 'P.I' or 'Entwurf 1'. It failed because its engine and undercarriage arrangement were unsuitable. GDC





ABOVE AND BELOW: Wind tunnel models of Focke-Wulf's Jäger mit Junkers-Turbinentriebwerk design. More is known about this design than any of Focke-Wulf's other early jet fighter efforts. via author

When the contest was announced, Baubeschreibung Nr. 272 was redesignated Nr. 280, presumably to make it appear more recent than projects already known to the RLM which had a number higher than 272.

Three 'cases' were set out in both documents. The first and second described differing fuel loads for the aircraft when equipped with the rocket engine, while the third showed how fuel load could be distributed if no rocket engine was fitted and therefore no rocket fuel was needed.

As mentioned, aside from the Focke-Wulf single-jet fighter chronology, the rest of the Considerations for Designing a Single-Engine Fighter Aircraft with Turbojet report is devoted to explaining the inferiority of the Me 262 to the Baubeschreibung Nr. 280 aircraft.

It states: "With the existing HeS 011 turbojet it is possible to develop a single-engine jet fighter with better flight performance than any other fighter and this can be reached with low material and production costs as well as low fuel costs.

"This aircraft design is described in the Fw-Baubeschreibung Nr. 280. The objective of the present report is to provide the proof for the above surprising assertion on the basis of verifiable data."

The report includes graphs comparing the performance of what it calls the "Fw-TL-Jäger" with the performance of various Allied piston engine aircraft – showing the Focke-Wulf aircraft to be faster, though not by a huge margin.

In explaining this, the report states: "In this context it should be emphasized that this TL-fighter is essentially intended for use against Otto aircraft, not against jet fighter or jet bomber aircraft."

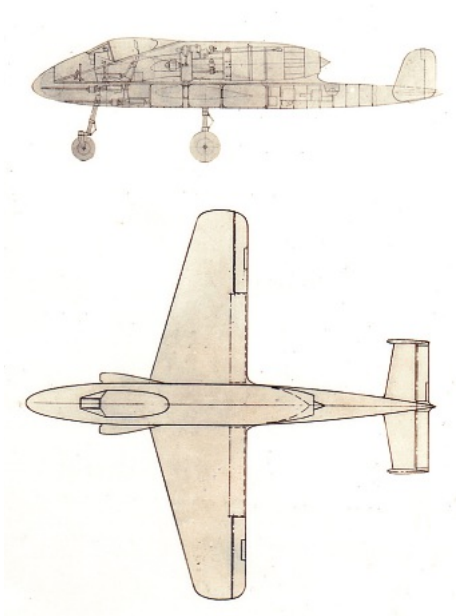
It is suggested that both German and Allied jet aircraft may soon reach their maximum possible potential due to the limits imposed by the sound barrier or 'critical Mach'.

Also shown on the graph is the estimated performance of the Me 262. The report states: "From the graph of horizontal velocities it can be seen that the Me 262, based on data from Rechlin, has a lower maximum speed than the Fw-offer.

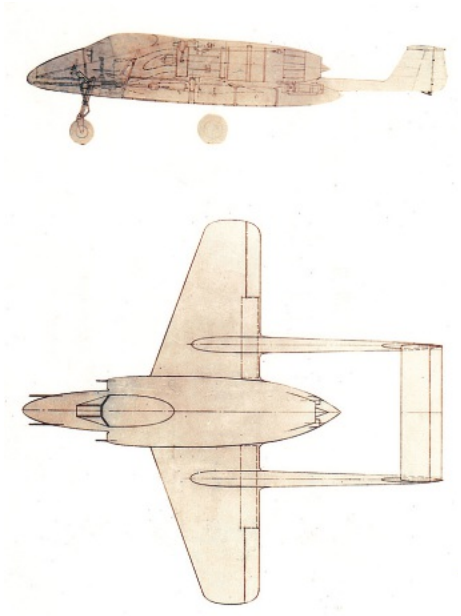
"Of the speeds and their expected development we can say the following: 1) The Fw-TL, using the HeS 011 engine at 1500kg static thrust (possibly later 1700kg) can expect considerable speed increases as the engine is developed. The engine of the Me 262 no longer offers great development potential.

"2) Installation of HeS 011 engines in the Me 262 will only be possible after a thorough redesign of the airframe, as in the current design the performance of the HeS 011 cannot be properly exploited due to critical Mach number."

Comparing rates of climb, the report states that the "Fw-TL-Jäger and Me 262 are quite

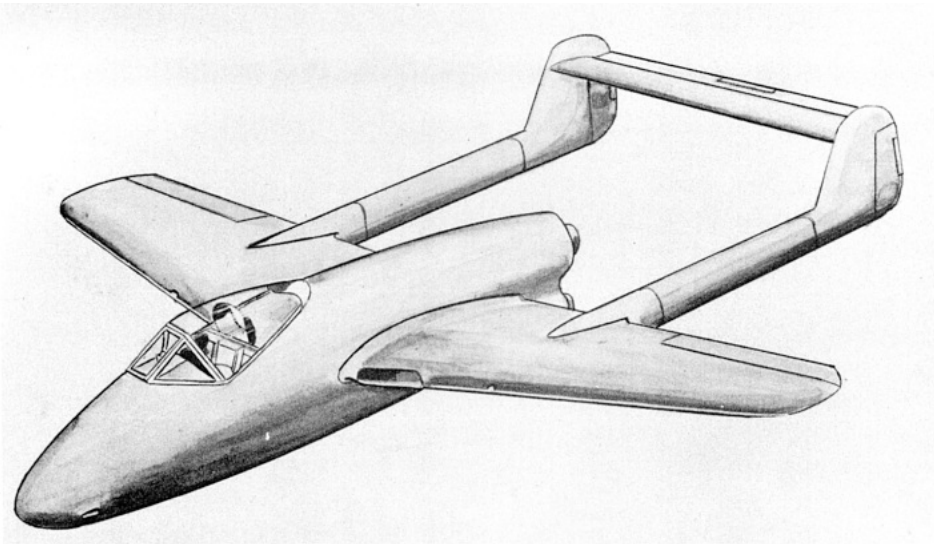


ABOVE: With its engine mounted on top of its fuselage, the November 1943 Focke-Wulf jet type succeeded in deflecting all the criticism aimed at its predecessors, but its jet intakes were deemed unsatisfactory. GDC



ABOVE: Another design for which the correct designation is unknown, this December 1943 Focke-Wulf jet fighter sees the first appearance of the twin-boom tail and jet engine combination. GDC

ABOVE AND RIGHT: Two photographs taken in 1944 show models of Focke-Wulf's Nr. 279 and Nr. 280 designs being test flown in front of an audience on the same day. It is evident that despite the dates given in Focke-Wulf's own document, the two designs were each considered as serious contenders of the 1-TL-Jäger competition. via author



ABOVE: This image from a postwar American report shows the Focke-Wulf Nr. 280 design that was submitted for the 1-TL-Jäger competition complete with rocket booster unit in its tail. This was to enable it to climb quickly – rather than to increase its top speed. GDC

comparable", but also suggests that the Me 262's narrow airframe would not be able to carry sufficient extra fuel to make the installation of a climb-boosting rocket engine worthwhile.

Comparing single and twin-engined fighters powered by an engine in the same power class, and with the same levels of equipment, the report notes that "the twin-engined fighter is always faster. For example, the Fw 187 is faster than the Me 109 with two Jumo 210, and the Do 335 is faster than the Ta 152.

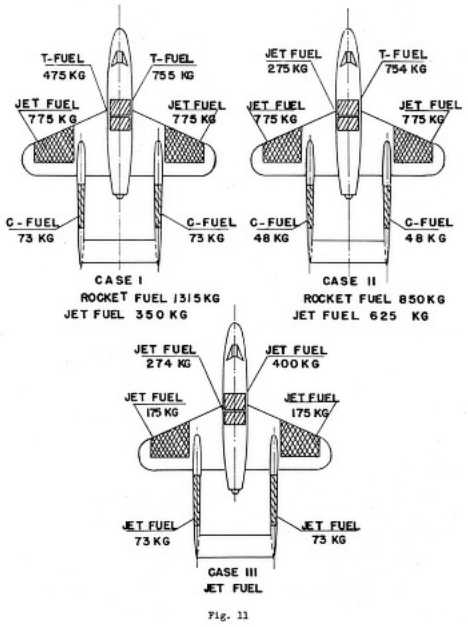
"However, through additional demands on equipment, flight time, etc. this superiority over the single-engine fighter is lost, as can be seen from comparison of the Ta 154 and Ta 152 or Me 109 and Me 410."

It goes on to point out that not only does it take more man hours and material to build a twin-engine fighter, it costs more too and "due to the larger dimensions of the twin-engine aircraft, flight characteristics such as agility, control force behaviour and so on are worse than those of the single-engine fighter.

"These same considerations apply equally to Otto engine fighters and fighters with TL engines. The fighter with two TL engines is just slightly faster than those with single engines."

But it costs more to build fighters with two engines. The report then compares four aircraft: a fighter like the Ta 152 powered by a Jumo 222E/F engine, a fighter similar to the Do 335 with two DB 603 engines, a fighter with an HeS 011 as per Baubeschreibung Nr. 280 and a fighter with two Jumo 004s similar to the Me 262.

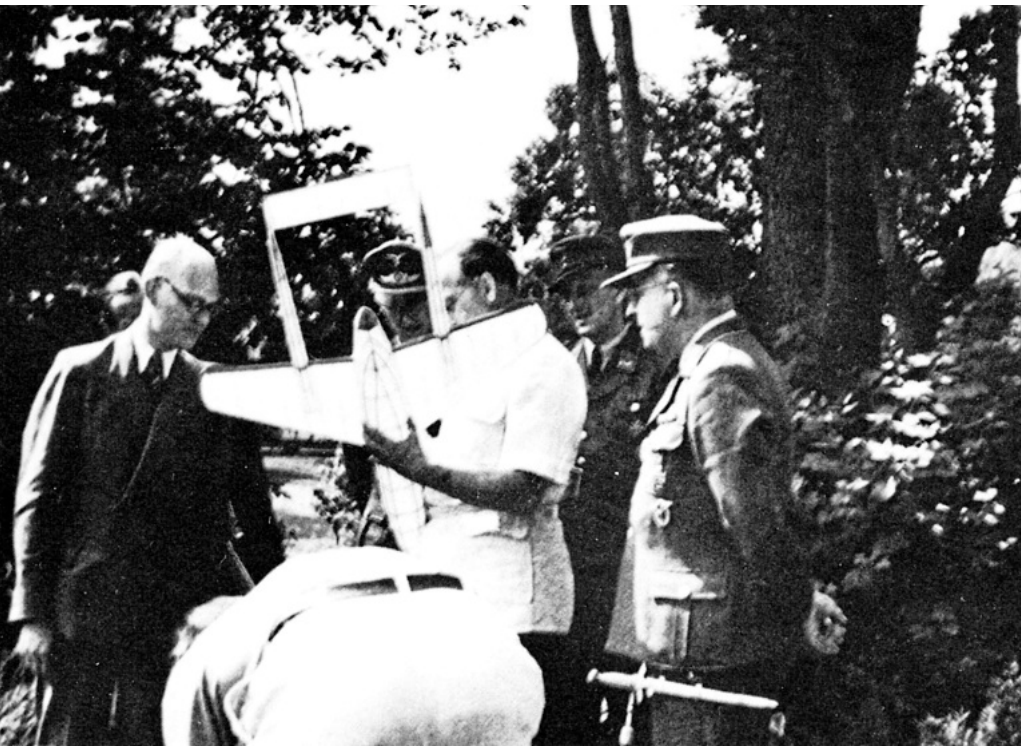
This, the report says, shows that the cost of producing piston engine aircraft with performance anything like that of the jet fighter is disproportionately high, and the cost of producing a twin-engine jet fighter is likewise out of proportion to any performance gain.

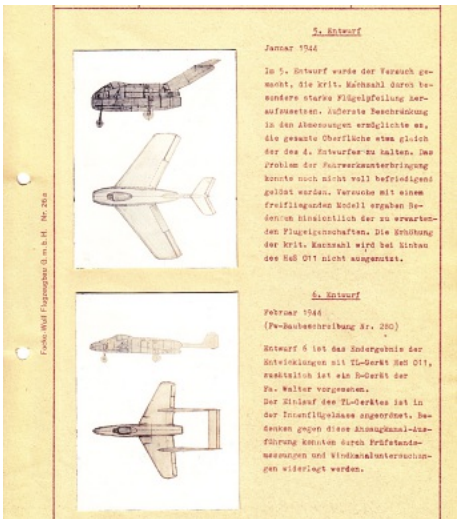


ABOVE: Focke-Wulf hoped that the adaptability and flexibility of its Nr. 280 design, rather than outright performance, would put it in a winning position. Experience with the Fw 190 had taught Focke-Wulf that the ability to carry a huge number of different payloads could be just as important to a fighter as simply being able to go fast. This image from an American report relabels original Focke-Wulf art showing the three different fuel loads that were possible with the Nr. 280 design. GDC

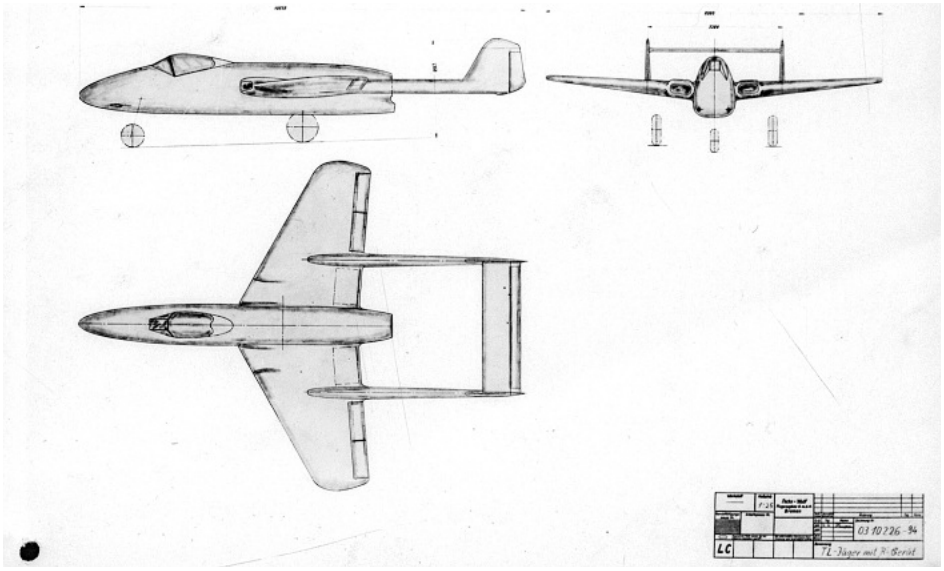
Finally, it states: "In conclusion, once again the benefits of the single-engine fighter-TL to Baubeschreibung Nr. 280 in comparison to the Me 262 are summarised. 1) The fuel consumption of the Fw-TL-Jäger is approximately only 63% of the Me 262. 2) The cost of materials for the airframe of the Fw-TL-Jäger is about 72% the cost of materials for a Me 262 airframe.

"3) The production cost for airframe and engine of the Fw-TL-Jäger is about 69% of the ▶

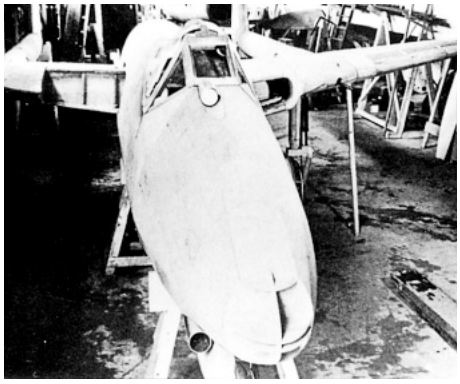


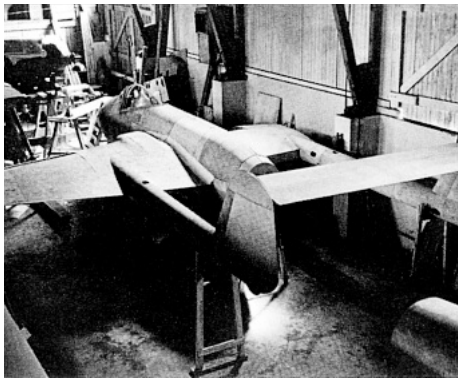


ABOVE: In the document submitted in support of its Baubeschreibung Nr. 280 aircraft, the lower of the two designs here, Focke-Wulf seeks to downplay the swept-wing design pictured above it – which was worked on at the same time and got its own Baubeschreibung document, Nr. 279. Careful examination of this image reveals a rocket engine above the exhaust of its turbojet, just beneath the tall upthrust tail unit. GDC



ABOVE: Drawing number 0310 226-94 shows a simple three-view of the Focke-Wulf Nr. 280 aircraft. TNA





ABOVE: So confident was Focke-Wulf of the Baubeschreibung Nr. 280 aircraft, that it produced a full scale mock-up to demonstrate its potential. via author

comparable value of the Me 262. 4) When fitted to the Me 262, HeS 011 engines will require an extensive remodelling of the airframe and new jigs would be required. New construction jigs would also be needed for the single-engine TL-Jäger so no disadvantage of this pattern can be derived.

"5) The Fw-TL-Jäger can achieve, with the rocket unit fitted as standard, climbing speeds exceeding 100m per sec. 6) The Fw-TL-Jäger can, with the maximum 1250kg jet fuel load assumed in case III, achieve an endurance of two hours at an altitude of 12km at full throttle even with fuel consumption during climb taken into account.

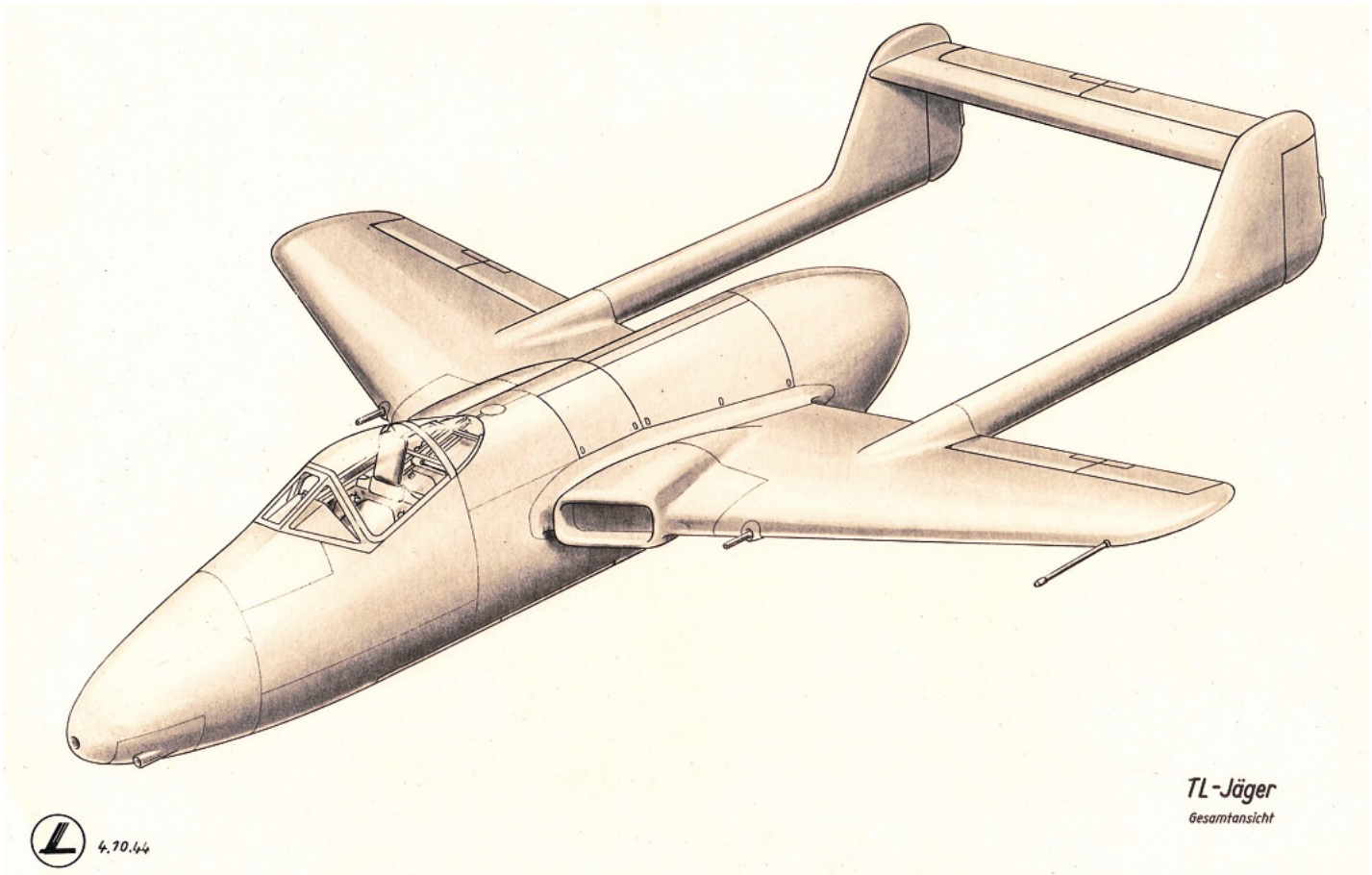
"7) As its fuselage is being constructed, the Fw-TL-Jäger can be fitted with the PTL 021 turboprop in place of the HeS 011. This would result in a take-off weight of 5000kg, a climb speed of about 32m per sec and maximum speeds of about 820kph on the ground."

FW-TL-JÄGER (SECOND TRY)

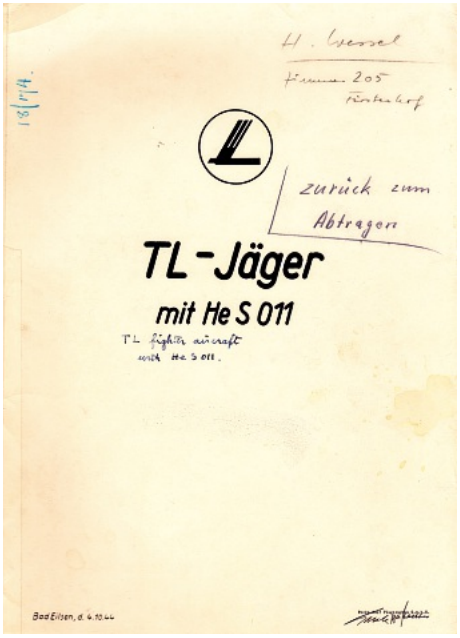
It seems to have come as a great shock to Focke-Wulf and its chief designer Kurt Tank when the Nr. 280 design was not met with universal acclaim at the first presentation meeting on September 8-10, 1944. The company had even gone so far as to construct a full scale mock-up in the belief that it was in possession of a winning design.

But now both of the 'cases' of the aircraft fitted with the rocket engine were rapidly dismissed as unnecessary by the adjudicators.

This left the 'case III' with its larger load of ordinary jet fuel. Without its rocket engine, however, the aircraft was slower than the other designs presented and lacked their climbing performance.



ABOVE: The October 1944 version of the Nr. 280 design had had its rocket booster removed. GDC



ABOVE: Even after its poor showing during the September meeting to discuss the first 1-TL-Jäger designs, Focke-Wulf persevered with its Nr. 280 design. This brochure was produced on October 4, 1944, to showcase some beautiful artwork showing different aspects of the design.

Over the next three months, Focke-Wulf's designers started amending the Nr. 280 design but eventually accepted that it was simply too slow and too complex compared to the other companies' designs.

In mid-October they switched their attention back to the '5. Design' that they had earlier rejected due to "concern about its flight characteristics".

Efforts were now concentrated on improving the type's flight characteristics and demonstrating its adaptability to a number of different combat roles.

All of this was encapsulated in Baubeschreibung Nr. 279 – perhaps indicating that, contrary to Focke-Wulf's own account, the type was actually more recent than the Nr. 272/280 design.

Baubeschreibung Nr. 279 begins by explaining at length how the design is intended to "raise the critical Mach number as much as possible". It goes on: "The displacement of the critical Mach number to the expected high values is to be attained by large sweepback in connection with small thickness of lifting and control surfaces and by employing an engine air intake with small excess velocity at the fuselage.

"Since the critical Mach number of the wing and empennage is to be expected to be higher than that of the fuselage, no abnormal flying qualities are to be expected in the range of velocities reached in level flight."

In other words, Focke-Wulf's engineers believed they had resolved the issues surrounding the design's flying characteristics at all speeds.

Outlining the type's suitability for a range of roles, the report says: "For use as an interceptor, there is provision for the installation of a rocket engine of 1000kg thrust which would make possible a climb to 10km in four minutes.

"The necessary fuel, weighing 1460kg, will be carried in two expendable external tanks

KNOWN FOCKE-WULF BAUBESCHREIBUNG OR 'SPECIFICATION' DOCUMENTS

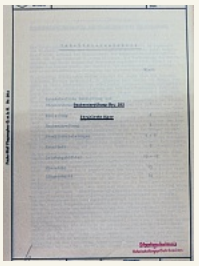
- **Nr. 230** Zwei mot kampfflugzeug (Fw 191)
- **Nr. 239** Verkehrsflugzeug Fw 206
- **Nr. 248** Jagdflugzeug Fw 190 A-8 (individual pages dated variously Nov 30, 1944; Feb 4, 1945; Nov 27, 1944; Nov 28, 1944, or Sept 8, 1944)
- **Nr. 264** Jäger mit Junkers-Turbinentriebwerk ('2. Design', dated June 9, 1943)
- **Nr. 265** Ta 154A
- **Nr. 271** Höhenjagdflugzeug Ta 152H (dated January 18, 1944)
- **Nr. 272** Einmotoriger TL-Jäger mit R-Gerät (twin boom single-jet fighter, dated February 1, 1944)
- **Nr. 279** 1-TL-Jäger (Ta 183)
- **Nr. 280** 1-TL-Jäger (seemingly the same as the Nr. 272 design, dated August 15, 1944)
- **Nr. 281** Einmotoriges Jagdflugzeug mit PTL-Gerat 021 (dated August 18, 1944)
- **Nr. 283** Strahlrohrjäger (ramjet fighter sometimes known erroneously as the 'Ta 283') (dated August 4, 1944)
- **Nr. 290** Ta 152C

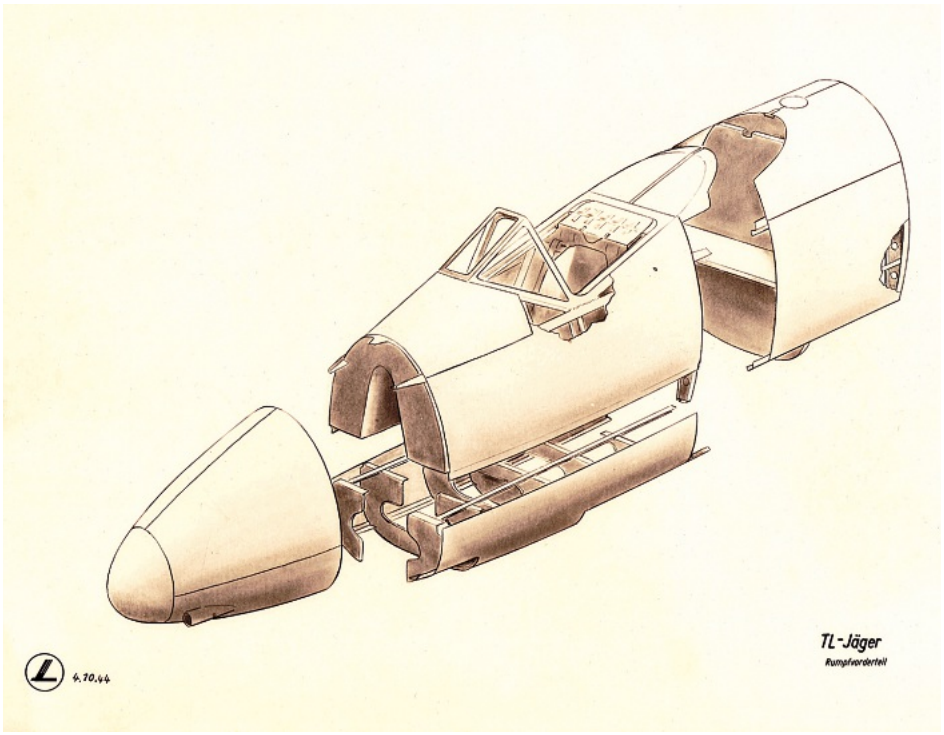
KNOWN FOCKE-WULF KURZBESCHREIBUNG/ KURSBAUBESCHREIBUNG OR 'BRIEF SPECIFICATION' DOCUMENTS

- **Nr. 23** Zweimotoriges TL-Jadgflugzeug mit HeS 109-011 (dated November 23, 1944)
- **Nr. 30** TL-Jäger mit HeS 011-Gerät (dated January 10, 1945)

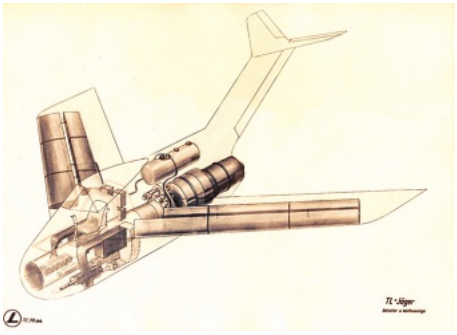
KNOWN FOCKE-WULF DRAWINGS

- **8 206 000-7064** Gerätetafein (date circa 1941, instrument layout for Fw 206)
- **03 10 025-501** Jäger mit Jumo 222 EF (August 30, 1944)
- **03 10 025-504** Motor u. Kühlen einbau (September 6, 1944, and September 29, 1944)
- **03 10 025-505** Jäger mit Jumo 222 E-F (September 13, 1944)
- **03 10 025-506** Jäger mit Jumo 222 E-F (October 2, 1944)
- **03 10 025-507** Flugelumriss. Hochleistungsjäger mit Jumo 222 E u. Lüftenrad (September 29, 1944)
- **03 10 025-509** Hochleistungsjäger mit Jumo 222 C/D (February 2, 1945)
- **03 10 025 559** Jabo mit Jumo 222 (date illegible)
- **03 10 025 560** Jabo mit Jumo 222 übersicht (October 24, 1942)
- **03 10 025-564** (title unknown – shows Fw 190 with forward swept wings, November 30, 1942)
- **03 10 141-11** Fw 190 V-19 mit Jumo 213 (undated)
- **03 10 141-14** Fw 190 V-19 mit Jumo 213 mit Ladeluftkühler (date illegible)
- **03 10 224-30** Fernkampfflugzeug m. 6 BMW 801E (March 3, 1943)
- **03 10 224-31** Fernkampfflugzeug m. 6 BMW 801E (March 6, 1943)
- **03 10 224-33** Fernkampfflugzeug m. 6 BMW 801E Anordnung der Panzerung (undated)
- **03 10 224-34** Fernkampfflugzeug mit 6 BMW 801E (undated)
- **03 10 224-50** Fernkampfflugzeug m. 6 x Hs 293 (May 10, 1943)
- **03 10 224-52** Fernkampfflugzeug m. 3 x Hs 294 2 x Hs 293 (May 10, 1943)
- **03 10 226-31** Jäger mit Turbinentriebwerk (June 7, 1943)
- **03 10 226-32** Jäger mit Turbinentriebwerk (June 7, 1943)
- **03 10 226-40** Jäger mit Turbinentriebwerk (July 12, 1943)
- **03 10 226-61** Strahljäger mit HeS-011 Gerät (January 29, 1944)
- **03 10 226-62** Strahljäger mit HeS-011 Gerät (January 30, 1944)
- **03 10 226-63** Auftankzustände (January 31, 1944)
- **03 10 226-94** TL-Jäger mit R-Gerät (August 4, 1944)
- **03 10 226-126** PTL- Jäger mit PTL-021 (date illegible)
- **03 10 226-127** PTL- Jäger mit PTL-021 (date illegible)
- **03 10 231-02A** Längsschnitt Jäger mit BMW 803 (before February 12, 1944)
- **03 10 231-04A** Jäger mit BMW 803 (before February 12, 1944)
- **03 10 239-01** Bomber mit 2 HeS 011 (April 12, 1944)
- **03 10 240-004** Triebflügeljäger mit L-Antrieb (September 30, 1944)
- **03 10 240-005** Fahrwerk für Triebflügeljäger (October 4, 1944)
- **03 10 246/10-02** Strahlrohrjäger
- **03 10 251-22** Schlechtwetterjäger mit DB 603N + 2 TL 003 (mixed population night fighter of January 1945)
- **03 10 251-50** Nachtjäger mit 2 x HeS 011 Entwurf II (date unknown but before March 19, 1945)
- **03 10 251-51** Nachtjäger mit 2 x HeS 011 Entwurf II (March 6, 1945)
- **03 10 251-52** Nachtjäger mit 2 x HeS 011 Entwurf III (March 10, 1945)
- **03 10 251-53** Nachtjäger mit 3 x HeS 011 Entwurf IV (date unknown but before March 19, 1945)
- **03 10 251-54** Nachtjäger mit 3 x HeS 011 Entwurf V (date unknown but before March 19, 1945)
- **03 10 252-100** Jäger mit TL-Triebwerk Entwurf 2 (October 30, 1944)
- **03 10 252-103** TL-Jäger mit HeS 011-Gerät Übersicht (date unknown but before January 10, 1945)
- **03 10 252-115** TL-Jäger mit HeS 011-Gerät Längsschnitt (date unknown but before January 10, 1945)
- **03 10 256-03** Trägerflugzeug (February 7, 1945)
- **03 10 256-04** SO-Flugzeug
- **03 10 256-05** Schnellbomber
- **10 10 05-201** Fw 190 mit BMW P 8028 (undated)
- **10 10 05-202** Fw 190 mit BMW 801 J (undated)
- **10 10 05-203** Fw 190 mit DB 609
- **10 13 141-02** Fw 190 mit DB 623 A (date unknown but before January 1943)
- **10 13 141-16** Fw 190 mit DB 614 (undated)
- **10 25 001-18** Jagdflugzeug Ta 152 C Längsschnitt (February 7, 1945)
- **11 19 05-502** Fw 190 mit BMW 8011

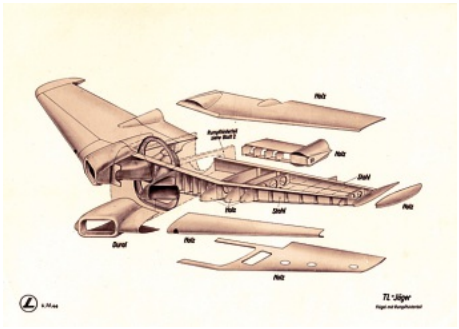




ABOVE: Around a dozen detailed constructional drawings were included in Focke-Wulf's October 4, 1944, brochure for the Nr. 280 design – presumably to give the impression that it could be built very quickly once an order was placed. GDC



ABOVE: Another piece of original Focke-Wulf art, depicting the major internal components of the Nr. 279 type. GDC



ABOVE: A drawing showing the internal wing structure of the Nr. 280. GDC

Hence this particular tactic can be taken care of by additional equipment. For tactical use as a fighter-bomber, a bomb load of 500kg may be carried in the fuselage in such a way that the bombs protrude only about half way out of the fuselage.

"Because of the high performance, the armament is restricted to two MK 108s with 100 rounds of ammunition. With a sacrifice of 600m in ceiling one can easily install two additional MK 108s with 60 rounds of ammunition each."

After listing the aircraft's various construction details, under a heading of 'special equipment' the report states: "For use as an interceptor, an R-unit with 1000kg thrust is added to the TL-engine. The pumps of the former are driven by the latter.

"For operation of the TL-unit one-half of the normal amount of fuel is carried.

"The C-Stoff and T-Stoff are carried in two external droppable tanks which are hung under the wing at unequal distances from the centre of the fuselage so that the normal position of the centre of gravity is preserved.

"The duration of thrust has been measured to be 200 sec. The difficult to handle rocket fuel can in this way be stored in the tanks and makes it possible for ground personnel to rapidly ready the aircraft. Take-off weight is approximately 10,800lb."

Both the main landing gear struts of the tricycle undercarriage and the pilot's seat were to be Fw 190 items. The sliding pilot's canopy and jettison mechanism were to be "taken 90% from Fw 190".

The aircraft was to be made of steel (45.3%), duraluminium (25%), plywood (25.9%) and miscellaneous other materials (3.8%).

Drawings of the Baubeschreibung Nr. 279 aircraft dated late October are subtitled 'Design 2', with the Nr. 280 type having been 'Design 1'. This persisted into the next 1-TL-Jäger meeting, on December 15, 1944, at which no decision was made.

However, as preparations were being made for the February 27-28, 1945, meeting where it was expected that a winner would finally be chosen, Focke-Wulf decided to submit another design, closely related to the Nr. 279 aircraft alongside it. For simplicity's sake, the Nr. 279 aircraft therefore became 'Focke-Wulf I' and the new design was presented as 'Focke-Wulf II'.

FOCKE-WULF PROJECT NAMES

Successive historians have been puzzled by Focke-Wulf's unorthodox system for naming its projects. Some have claimed that the company had no system, some that it only used drawing numbers, others that it called everything 'Projekt I' or 'P.II' and yet more simply take the middle portion of drawing numbers, add 'Fw', and call the type shown in drawing 03 10 252-103, for example, the 'Fw 252'.

Some historians have even come up with their own names. For example, of the three sample designs shown in Rotta's Fundamentals For The Design of a Jet Fighter, one writes: "The Focke-Wulf company devised a radical design known as the Fw Vorschlag 1 (Proposal 1)". Yet the word 'Vorschlag' does not appear once on any of the 24 pages of Rotta's report.

Focke-Wulf kept a master list of drawing numbers and a set of Baubeschreibung or 'specification' documents.

In commencing a new project, the design office would allocate a block of unused numbers from the list, projects begun from scratch rather than being based on an existing design usually starting with '03 10'.

The project would also receive a functional and descriptive name such as 'Jäger mit Jumo 222 E-F' or 'Fernkampfflugzeug mit 6 BMW 801E' that it would retain throughout.

To begin with however, none of the designers' sketches would receive a number. Numerous ideas were roughed out, including three-views and closeups to illustrate wing shape, engine fitting or cockpit visibility, before a decision was made as to which of these should be selected to best represent the project.

They were then redrawn, often being lightly shaded in the process, and given official numbers from the allocated block. Most would also have the project name written on them, or a minor variation of it, along with the date when the 'redraft' was completed.

This is as far as some projects got. Those that were to be further discussed, particularly those expected to be shown to non-Focke-Wulf personnel, would be the subject of a Baubeschreibung. This was essentially a report, illustrated with the relevant project drawings, dealing exclusively with one particular design or proposed type.

Copies of this report, for which the drawing numbers and information boxes were usually but not always cropped off, could then be circulated to interested parties.

Baubeschreibung documents were numbered arbitrarily, probably starting with number 200 in the late 1930s or early 1940s, and a 'library' copy was kept updated if a design was progressed beyond the initial compilation of the report. Outdated pages were removed and new ones inserted.

Designs that reached the level of being submitted for a major government contract retained their Baubeschreibung number, and this was referred to in supporting documentation presented to the adjudicators by Focke-Wulf, but to make matters nice and simple, the company typically referred to its competition entries as 'Focke-Wulf I' or 'Fw Entwurf II' – Focke-Wulf Design 1 or Focke-Wulf Design 3.

'II' AND THE TA 183

The Focke-Wulf II design, outlined in Kurzbaubeschreibung or 'short specification' Nr. 30, was related to but distinct from the 'I' design. In some ways it represented a more conservative approach. Its cockpit was located more centrally in the fuselage to give a longer nose, the wings were less sharply swept back and the tail was of a more conventional design.

The tricycle landing gear was little changed, as was the position of the engine. Armament was still two MK 108s but it was only possible to upgrade this to three, rather than four, and only at the expense of the forward fuel tank.

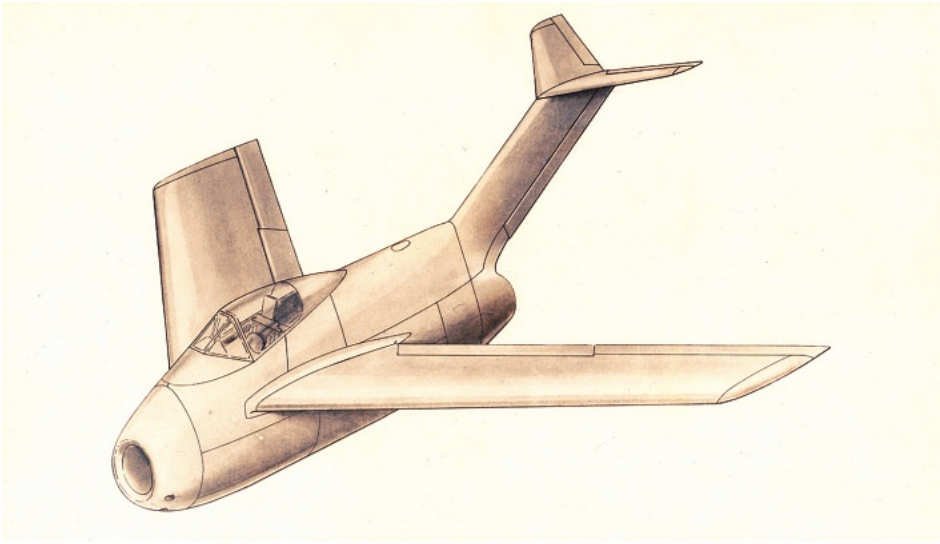
According to the official performance calculating formula devised by the DVL, the 'II' design was faster than the 'I'. The former could manage 597mph at 23,000ft, while the latter could only do 593mph. Rate of climb was also better, with 'II' managing 4550ft/min compared to 4020ft/min for 'I'.

Despite this, and despite the fact that the Messerschmitt designs submitted for the 1-TL-Jäger competition generally outperformed those of Focke-Wulf, following the February 27-28 meeting, Focke-Wulf was awarded a contract for the construction of an unknown number of prototypes of the 'I' design with the official RLM designation Ta 183.

It is likely that despite its relatively mediocre performance on paper, Focke-Wulf's 'I' design was chosen simply because it was deemed the most well developed of all the projects presented and therefore the one that could most quickly be put into production. Messerschmitt's apparently high performance designs were little more than three-view drawings at this stage.

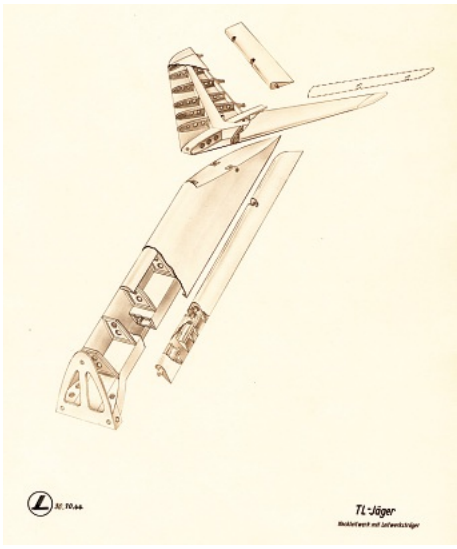
The Ta 183 V1 was expected to make its first flight in late May or early June 1945 and was to test the tail units of both the 'I' and 'II', since they were interchangeable.

Had the war continued, it was anticipated that the first production model Ta 183 would have rolled off production lines in October 1945. The capture of Focke-Wulf's headquarters by British troops on April 8, 1945, however, brought all work on the Ta 183 to an end. ●



ABOVE: Brochure artwork showing Focke-Wulf's Baubeschreibung Nr. 279 aircraft, dated October 30, 1944. By now, the Nr. 279 design had replaced the Nr. 280 as the company's main contender in the 1-TL-Jäger competition. GDC

ABOVE: Cover of the Focke-Wulf brochure for its Nr. 279 design, dated October 30, 1944. GDC



ABOVE: Focke-Wulf drawing showing the internal structure of the Nr. 279 aircraft's unusual T-tail. Had a prototype been constructed, this would have been tested alongside a more conventional tail design. GDC

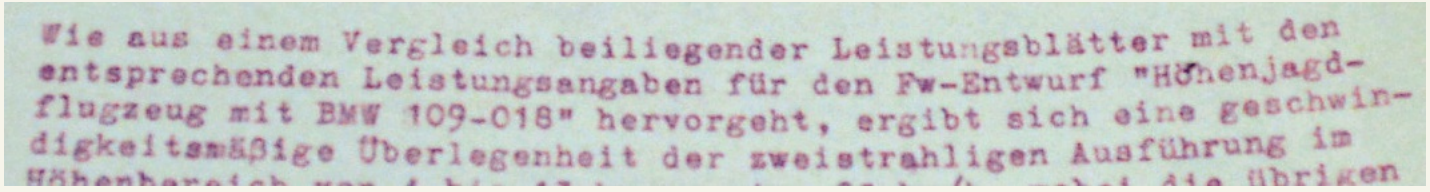
This was not the design's 'name', it simply allowed discussions in the context of a particular competition to centre around 'Focke-Wulf's first design' or 'Focke-Wulf's second design' rather than trotting out the Baubeschreibung number, or worse, the drawing numbers.

On this basis, where the drawing numbers, project titles or Baubeschreibung numbers are unknown, any means of correctly naming the Focke-Wulf project in question has been lost and its official designation is entirely unknown.

Two Focke-Wulf projects, those detailed in Baubeschreibung Nr. 279 and Nr. 280, acquired 'humorous' unofficial nicknames after the war – 'Huckebein' and 'Flitzer' respectively. The Nr. 279 design, which was eventually designated Ta 183 by the RLM, was apparently named after a cartoon character created during the 19th century that was still popular in Germany during the war years – Hans Huckebein the raven. Huckebein was fond of getting drunk and usually came to a sticky end. The significance of this to the Ta 183 may be guessed at.

The origin of 'Flitzer', meaning 'whizzer' or 'dasher' for Focke-Wulf's single-engine twin-boom fighter of Baubeschreibung Nr. 280 (but also Nr. 272), is more obvious. The design's non-rocket assisted maximum speed at any altitude was 515mph – making it one of the slowest jet fighter projects of the era and hardly a 'whizzer'.

No contemporary document makes any reference to 'Flitzer' or 'Huckebein'.

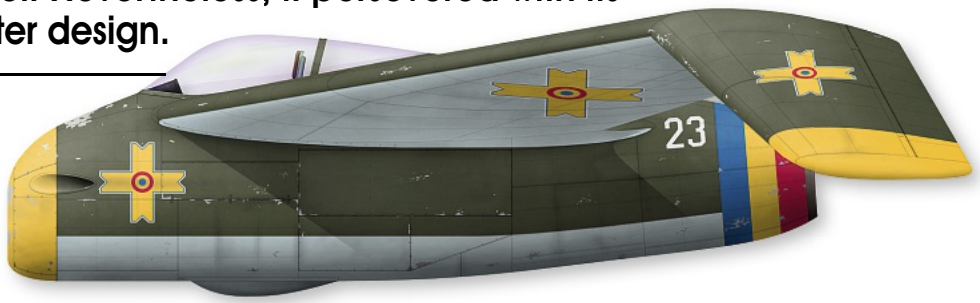

Wie aus einem Vergleich beiliegender Leistungsblätter mit den entsprechenden Leistungsangaben für den Fw-Entwurf "Höhenjagd-flugzeug mit BMW 109-018" hervorgeht, ergibt sich eine geschwin-digkeitsmäßige Überlegenheit der zweistrahligen Ausführung im

A quote from Focke-Wulf Kurzbeschreibung Nr. 23 Zweimotoriges TL-Jagdflugzeug mit HeS 109-011, making reference to a different company project by name, Fw-Entwurf "Höhenjagdflugzeug mit BMW 109-018". These long winded names were how Focke-Wulf generally referred to its own projects, or by their Baubeschreibung number if the project had one. It's not hard to see why the firm simplified this to 'Focke-Wulf I or Focke-Wulf II' for major competitions. GDC

P.1078

1-TL-Jäger – Heinkel

Almost as soon as the 1-TL-Jäger competition had begun, the main effort of Heinkel's design department was diverted towards what would rapidly become the He 162 Volksjäger. Nevertheless, it persevered with its more complex single jet fighter design.



ABOVE: The Heinkel P.1078C as it might have looked in Romanian service. Art by Chris Sandham-Bailey

It is likely that the first design presented by Heinkel for the 1-TL-Jäger competition on September 8-10, 1944, was a variant of the company's P.1073 design.

However, as with the other companies, by the time of the February 27-28 meeting, Heinkel was proposing a very different layout for its HeS 011-powered fighter.

The German report prepared in advance of this meeting, Comparison of Designs for 1-TL-Jäger, indicates that Heinkel's submission, the P.1078, is new or a substantial redesign when it notes: "The design of EHF (Heinkel) was not included in the comparison of performance and weight, as it was not ready at the time."

The data that was to hand, including drawings, showed a "tailless mid-wing plane with swept back wings and controls at the end of the wings. Wings contain the total fuel supply. Nothing further known. Fuselage: In the point of the fuselage above the flattened out, curved and elongated inlet pipe, the pilot's cabin is situated, the same applies to both the MK 108s, and under it is the nose wheel housing.

"The main undercarriage is under the wings and the equipment above it. This is completed by the engine. The function of the controls (elevators, lateral controls and ailerons) is performed by the downward sloping wing tips."

The part of the report focusing on the P.1078's engine acknowledges differences from designs previously submitted for the type: "The engine built into the fuselage is different from those previously supplied in copies, as it has a new location for the generator and starter. Air is carried from the point of the fuselage through a flat curved inlet pipe."

Armament was to be a pair of MK 108 30mm cannon, one on either side of the pilot. Fuel load was 1450 litres and bullet-proofing was "in hand".

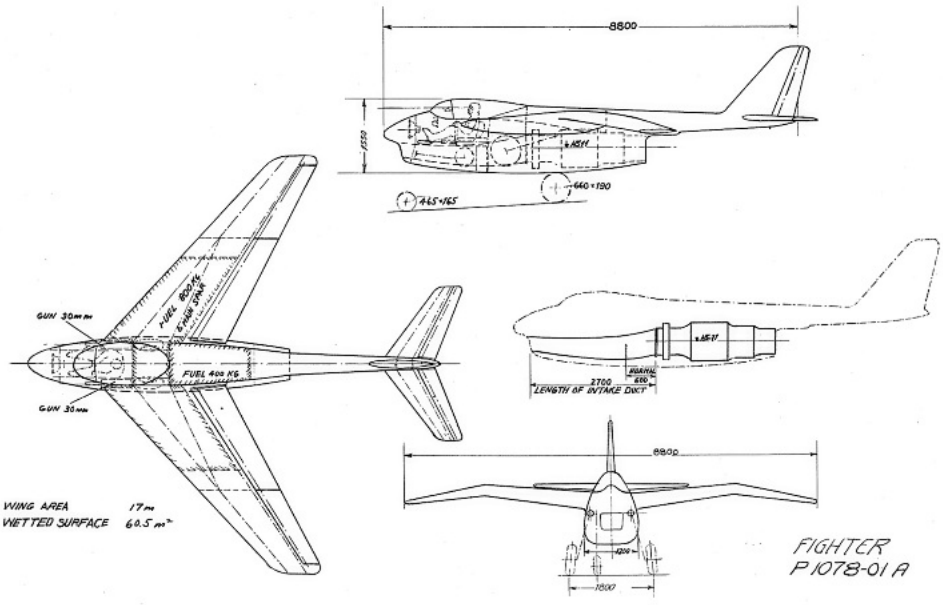
Details of the earlier P.1078 design, probably presented for the first time at the December 15, 1944, meeting, are not known for certain. Immediately after the war, however, the Americans compelled Heinkel's designers to reproduce some of their earlier designs – many of which had been lost when they were forced to relocate from Vienna in a hurry to avoid the advancing Red Army.

Among the reports produced was Jagdeinsitzer mit Strahltriebwerk HeS-11 by Eichner and Hohbach – two Heinkel designers.

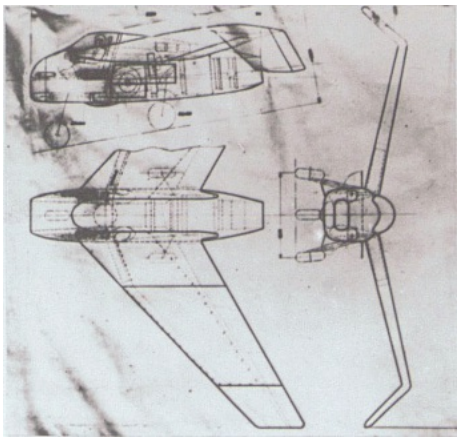
The document seems intended to give an insight into the P.1078 project during the war, although it has been suggested that the P.1078A and P.1078B it outlines were in fact entirely new designs concocted for the Americans' benefit.

The P.1078 design submitted to the February 27-28 meeting is labelled the 'P.1078C' in the British report German Aircraft: New and Projected Types of January 1946. Eichner and Hohbach's report seems to suggest the P.1078A and B are earlier, even though the only known drawings of them were produced later.

It begins: "Summary: The extraordinary shortcoming of our oil production forced us to design lighter single-place fighters with reduced equipment. Armament: 2 x MK 108 30mm calibre, the rate of fire would be increased to 900 rounds/min per gun, also, a radar aiming mirror.



RIGHT: A drawing of the Heinkel P.1078A made for the Americans by captive Heinkel staff. Evidence suggests that the P.1078A was the company's replacement for the P.1073 in the 1-TL-Jäger competition after it was chosen to become the Volksjäger. GDC



ABOVE: Drawing of the P.1078 from the report compiled in advance of the 1-TL-Jäger meeting on February 27-28, 1945. TNA

"A construction with two turbojets (like the P.1079) would be the best regarding space for pilot and armament. But, in Germany a new smaller turbojet with the same thrust/weight ratio and specific fuel consumption as the HeS-11 was not expected and the use of one HeS-11 had to be the basis for new fighter projects.

"The output of this turbojet gives the demanded increased flight performances with somewhat increased equipment and a one ton increase in gross weight as compared with the He 162.

"The fundamental question, whether with the same construction one big turbojet has less weight and consumption than two small turbojets, each with half the thrust, was still not answered by our turbojet designers (a small turbojet for the V-1 was under construction by Dr Porsche; the data are not known).

"This report contains two projects of single place fighters with one HeS-11; one project with tail, with turbojet in the lower part of the fuselage, the other is that of a tailless aeroplane, as far as possible designed as an all-wing aeroplane.

"The project with tail has a considerably smaller ratio of wetted area/wing area than the He 162. The idea for this new project was conceived before the construction of the 162 and it was also known that this design would give somewhat better performances.

"But, the questioned production engineers of those firms which were engaged for the production of the 162 declared that the preparation for the series production of the He 162 would be considerably more rapid. Because of the situation at that time, this was the deciding factor."

P.1078A

The "project with tail" that was conceived before the He 162 was built was the P.1078A.

In the section of the report describing the P.1078A, it states: "The static structure has only a small fuselage cross-section above the turbojet, and in the forward part of the fuselage loads are transmitted to a construction of flat side walls in the interior of the fuselage about the air intake duct.

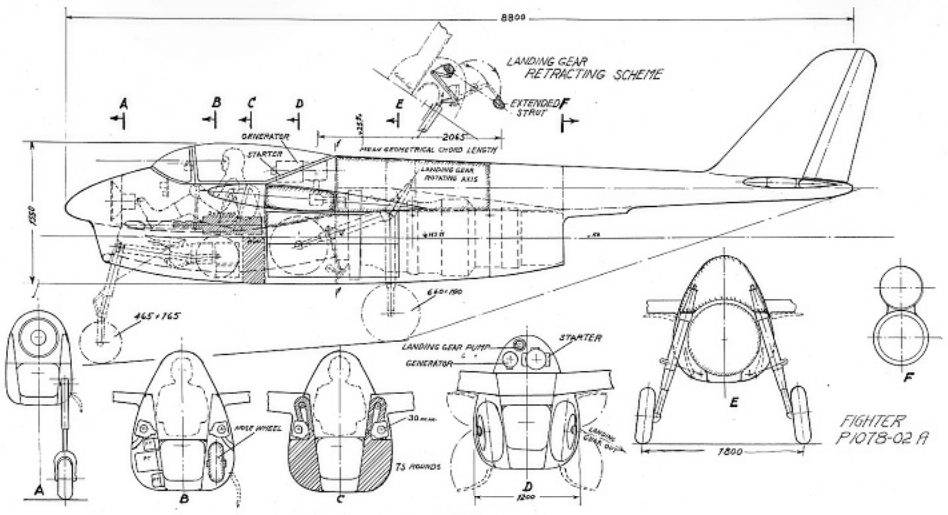
"The retracted wheels lie beside the air intake duct. This construction is particularly suitable for the HeS-11 because the diameter of this turbojet is considerably larger than the diameter of the air intake cross-section.

"The structural walls just described stop the retracting wheels so that only between wheel and door is a clearance margin necessary, thus the landing gear well is not wide. The bearing of the shock absorber strut is in the upper part of the fuselage and the extended strut is locked in this bearing so that the retracting mechanism is not subjected to landing loads.

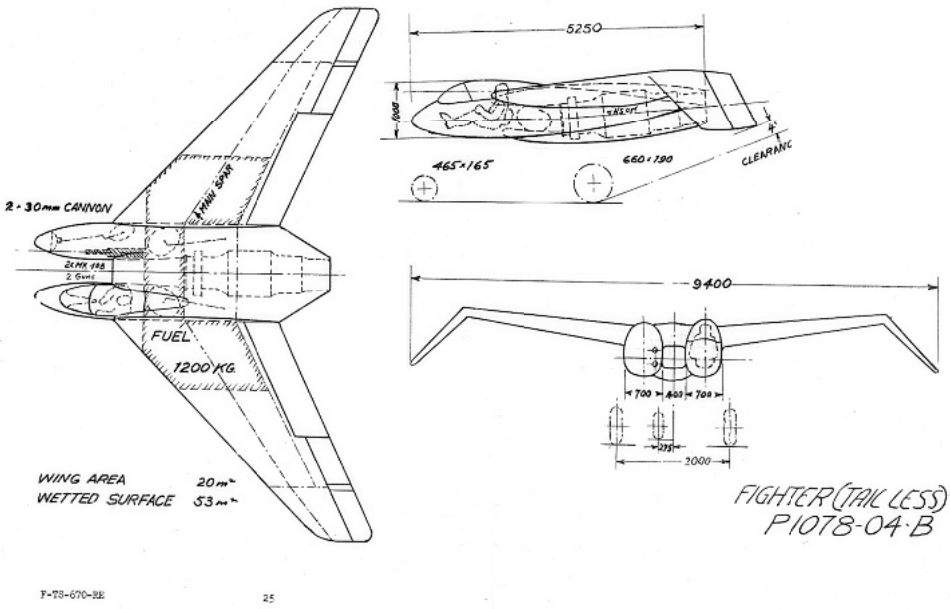
"The armament, ammunition, radio and the nose wheel lie beside the air intake duct in front of the main wheels. The utilisation of the total space for these parts necessitates changed armament and carefully considered construction, and limits the possibilities.

"A considerable increase of the armament weight would also cause an unacceptable loss of performance for an aeroplane with only one HeS-11. There is space in the fuselage nose for the radar aiming mirror. Most fuselage skin panels are detachable. Only the area next to the nose-wheel strut bearing is constructed integrally for strengthening."

It concludes: "Electric deicing is used. The use of fuel in wooden wing compartments was sufficiently proven by the last He 162 aeroplanes. In case of fire, the pilot is able to escape by a catapult seat."



ABOVE: A more detailed study of the P.1078A. GDC



ABOVE: The oddly shaped twin-nose Heinkel P.1078B. Although it was part of the P.1078 series, it seems unlikely that this design was entered for the 1-TL-Jäger contest. GDC

P.1078B

The "tailless aeroplane" was the P.1078B. The report says: "It was tried to construct this project as far as possible as an all-wing aeroplane, that is to make the ratio of wetted area/wing area as small as possible."

The design's highly unusual double nose layout apparently did no harm, aerodynamically: "The relatively slender two noses of the fuselage when taken singly have a considerable higher critical speed than the wing, DVL wing tunnel tests giving nearly M = 0.9. The noses are bent slightly together to decrease their reciprocal disturbance.

"The critical speed for the double nose is probably still better than for the wing with 40 degree sweepback. This can only be proved by wind tunnel tests. The air intake duct for the turbojet is particularly favourable."

The two designers then seek to justify their decision to have a vision restricting second nose without putting the jet engine into it: "When considering the arrangement, thought must be given to the problem if it would not be possible to build to advantage an asymmetrical type, that is, fuselage beside turbojet. However, without regard to the complication of the landing gear, a one-sided moment would have to be trimmed.

"It is almost impossible to achieve this trimming independent of the dynamic pressure and flight path incidence. This distribution would be unpleasant for a tailless aeroplane because the thrust/weight ratio is very great.

"The reduced vision to the front on the right seems to us the lesser 'evil' of the two particularly because an attack from this direction is not to be expected. Because of the very high speeds (1000kph) and the corresponding radii of turns, attack will probably come from behind and above."

The two nose sections were detachable and the armament was placed on the "inside wall" of the second nose "so as to keep the moment about the normal axis due to firing recoil as small as possible."

The P.1078C was not success at the February 27-28 and work on the project was, at that time, halted. ●

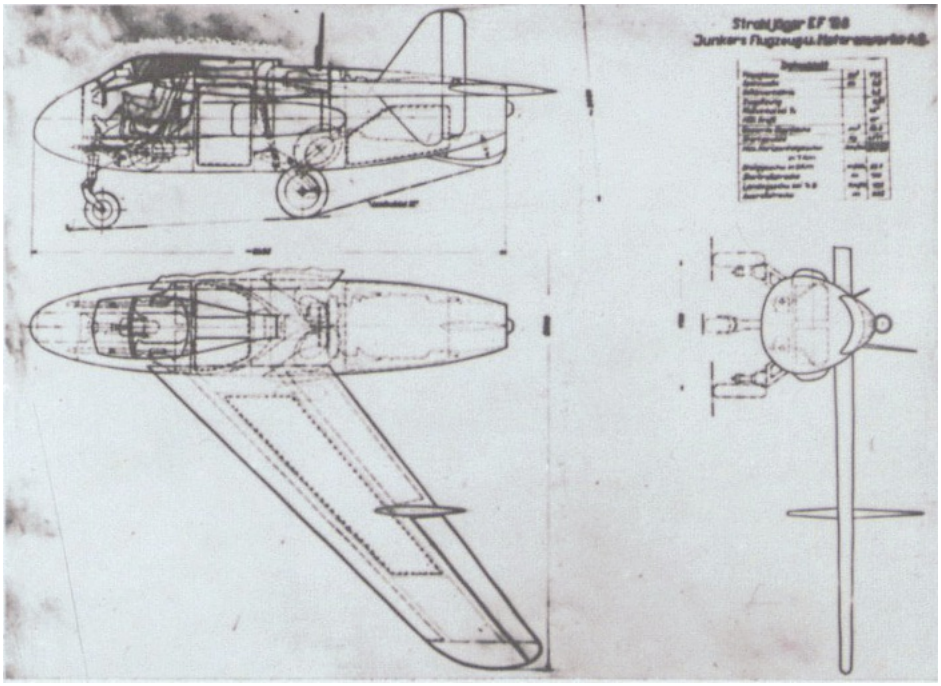
EF.128

1-TL-Jäger – Junkers

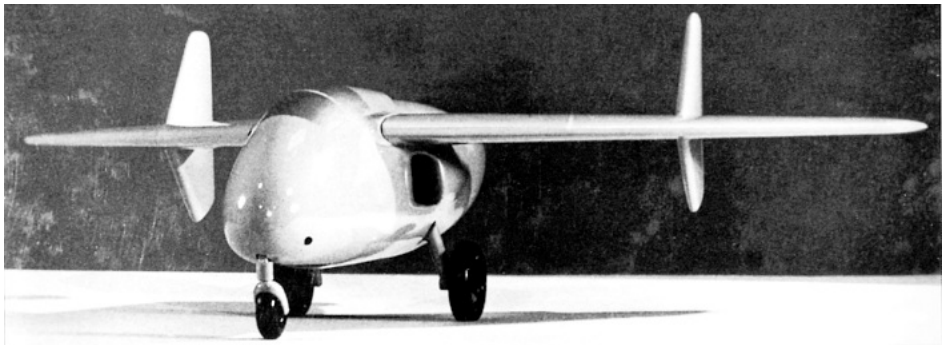
Designing advanced fighters came easily to Junkers thanks to its extensive aerodynamics research and experience – particularly in the fields of swept wings and area rule. Having already designed the EF.126 and EF.127 in early 1944 and then been absorbed by work on the Ju 248 – the EF.128 became the firm's final fighter project.

When the 1-TL-Jäger competition was announced in July 1944, Junkers was not among the companies invited to participate. However, during the first presentation of designs on September 8-10, it was decided that Junkers should be asked to submit a proposal.

When the Second World War begin, few German aircraft companies had their own wind tunnels, relying instead on the various aviation research institutes and organisations that were flourishing at that time. Junkers Flugzeug- und Motorenwerke in Dessau had, in contrast, owned and operated a variety of them since 1914.



ABOVE: One of the few known contemporary drawings of the Junkers EF.128, originally reproduced in Technical Intelligence report no. A-471. TNA



ABOVE: A forward view of what is purported to be a contemporary model of the EF.128. via author

Its most advanced wind tunnel, capable of testing models up to Mach 0.9, came into operation in October 1941 and the company began using this to carry out swept wing research towards the end of April 1943.

After testing a variety of wing shapes, the head of Junkers' flight mechanics department Hans Kaul and Hans Gropler, head of the firm's project office, issued a company memo supporting the further development of swept forward wings because they offered greater lift at low speeds than swept back wings, they avoided nose-down pitching movements associated with swept back wings and they allowed for a good separation from the tailplane.

However, in his report Use of Swept Forward and Swept Back Wings of April 29, 1943, Kaul also cited some significant benefits of swept-back wings such as reduced drag and otherwise superior aerodynamic features. He also wrote: "Calculations and measurements of lift distribution over a 35 degree sweptback wing with a taper ratio of over 0.53 reveal that premature separation over the outer part of the wing is not due to a high induced angle of incidence, which is caused by extreme twisting of the wing, but due to a thickening of the boundary layer.

"There is, therefore, the possibility of improving the behaviour of sweptback wings by using boundary layer suction." The use of wing fences for boundary layer control was also investigated – although these were positioned on the trailing edge of the wing whereas modern aircraft use them on the leading edge.

Extensive further low-speed wind tunnel tests were carried out on models with both swept-back and swept-forward wings up to June 20, 1943. From then until September 29, high speed tests were conducted. These led to the development of the EF.116, a forward-swept wing project about which little is known, followed by the EF.122 which was developed into the Ju 287 bomber.

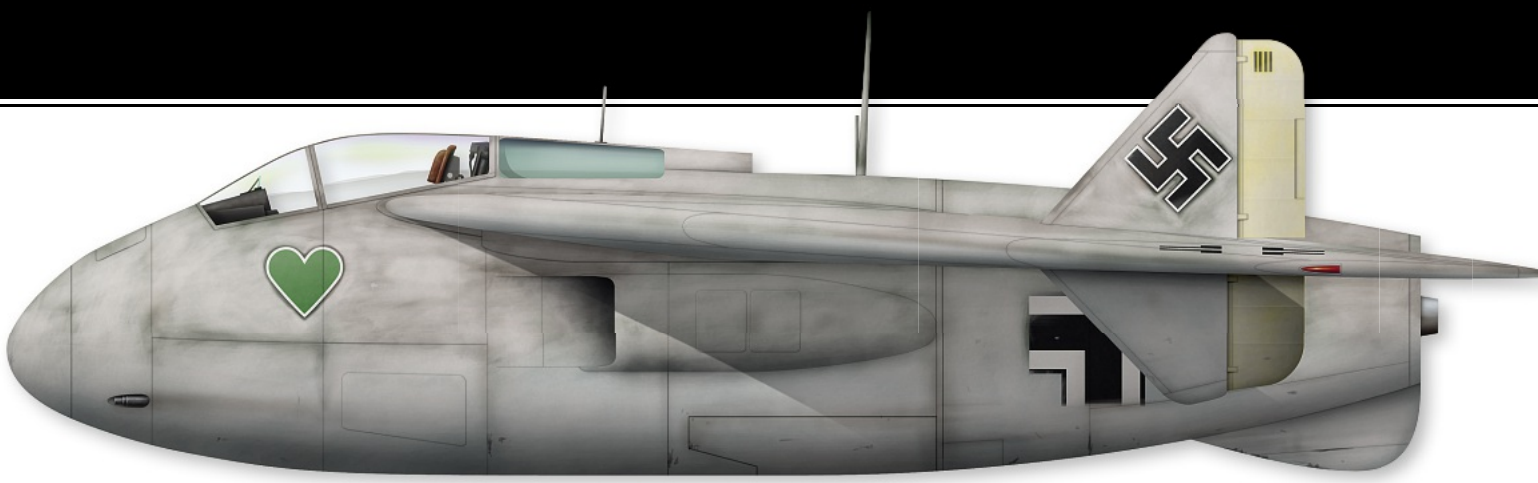
The latter was cancelled on July 7, 1944, but the company was already carrying out design work on its EF.126 'Elli' pulsejet-powered ground-attack aircraft and EF.127 'Walli' target defence interceptor. Then, during the late summer of 1944, Junkers began production of the Messerschmitt Me 163B interceptor.

Following on from this, its detailed proposal for the Ju 248 rocket-powered successor to the Me 163B was submitted to the RLM on October 11 – presumably at the same time that the first ideas for Junkers' 1-TL-Jäger were being committed to paper.

The first version of Junkers' 1-TL-Jäger design, the EF.128, is believed to have been presented two months later at the meeting on December 15. The design tested by the DVL in January 1945 was a tailless high wing aircraft with 45 degree swept back wings made entirely of wood. The inner part of these was designed to hold fuel.

The fuselage was all metal with a blunt nose which had "room for nose wheel and additional special equipment". There were a pressure cabin and "catapult seat" for the pilot and behind that a special air duct. Regarding the engine, the report prepared in advance of the February 27-28 meeting on the 1-TL-Jäger designs notes: "HeS 109-011 enclosed in rear of fuselage.

"Accessible through removable parts of the outer shell of the fuselage. Intake openings for the air suction on the side walls of the fuselage



ABOVE: The EF.128 was reportedly the subject of a development contract signed in March 1945. Had it entered service it might have equipped the famous Jagdgeschwader 54 'Grünherz', as depicted here. The nature of the panel on the upper fuselage is unclear. It may have been glass, to allow the pilot improved rear visibility, or it may have been a solid hatch allowing access to electronic equipment. Art of Chris Sandham-Bailey

under the wings. Boundary layer split provided. Suction of boundary layer air outlet duct at the end of the pilot's cabin dome."

No other entry to the 1-TL-Jäger competition had a feature like this. It was a system based on the boundary layer suction investigated by Junkers back in April 1943. The performance of the wings and the aircraft as a whole was to be improved through a redirection of air at high speeds.

Most of the aircraft entered for the contest had a fuel capacity of 1250 litres – as per the required specification – but the EF.128 could hold a substantial 1030 litres in two armoured tanks in the fuselage and another 540 litres unprotected in the wings – a total of 1570 litres. This would have potentially have given it the range and endurance to outlast all of its competitors except the Focke-Wulf II.

The capacious nose also offered the possibility of expanding armament to four MK 108s with 100 rounds each and there was bulletproofing with "the pilot protected against 12.7mm ammunition from the front and 20mm from behind".

It might have seemed that the EF.128 had sprung fully formed from the minds of its designers without much preamble but in reality it incorporated many of the lessons learned during the design and development of the Ju 248 – and during earlier wind tunnel tests.

Although the latter had a rocket engine rather than a jet, the basic internal layout of the two aircraft was similar, with a large fuel tank directly behind the pilot and the tricycle undercarriage retracting into the fuselage.

Where the two designs differed most greatly was the wings – those of the EF.128 were all-new where those of the Ju 248 were taken from the Me 163B – and the central/rear fuselage where the former had no need for a single vertical fin but did require intakes for its innovative air suction system.

Although Junkers came away from the February 27-28 meeting empty-handed, it was reportedly given a development contract for the EF.128 in late March. This is likely to have been because Junkers undertook to begin series production in mid-1945 and with its track record of bringing the Me 163B to mass production in record time, this was not necessarily an unbelievable claim.

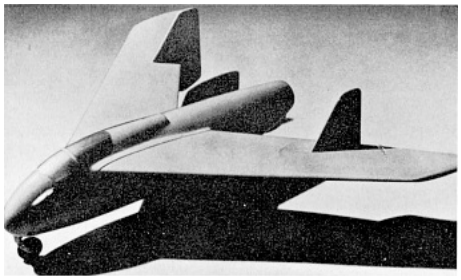
Junkers' airfield and its advanced projects drawing office at Dessau, along with all surviving documents, were captured by the Americans on April 24, 1945.

It has previously been claimed that the Soviets captured Junkers' documents, which would explain why none have become available to western historians in the 70 years since the end of the Second World War, but this was not the case.

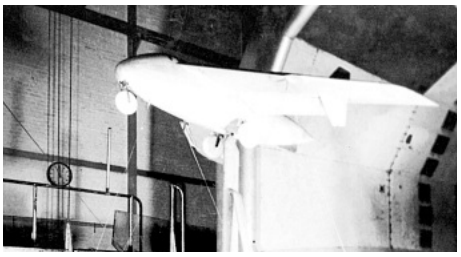
According to Gerd Fucke at the Technikmuseum 'Hugo Junkers' at Dessau, writing in 2013: "The first troops occupying Dessau were US troops, second were Soviets. It is likely that material exists in the US.

"The Soviets could only obtain drawings and reports from people's memories or secondhand. Nothing of the Junkers material has re-emerged since then, neither from the US nor from the Russians."

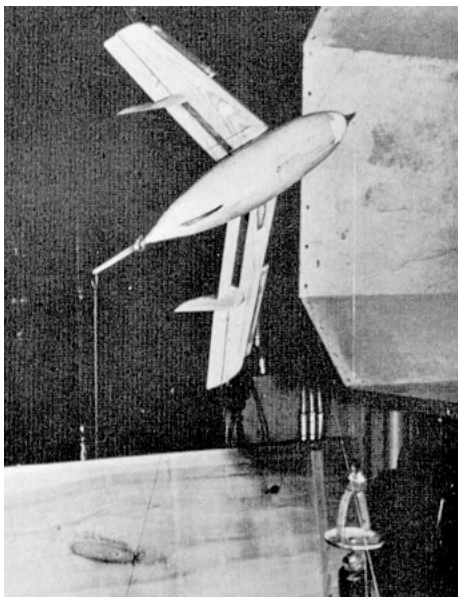
Consequently, little else is known in detail about the EF.128. ●

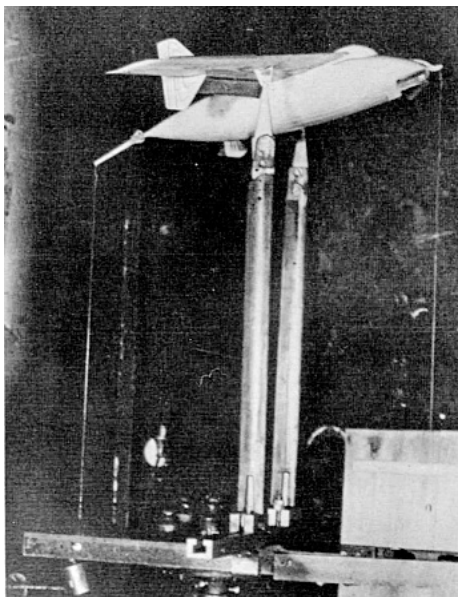


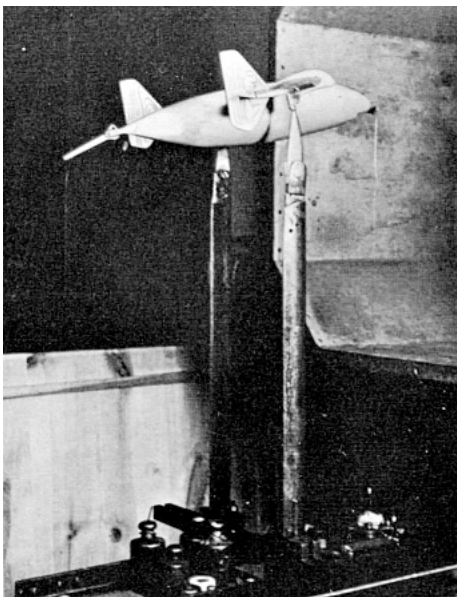
ABOVE: Another view of the contemporary model, showing the design's sleek lines to advantage. via author



ABOVE: Wind tunnel testing of an EF.128 model with its undercarriage extended. Junkers famously had more wind tunnels at its disposal than any other German aircraft manufacturer. via author





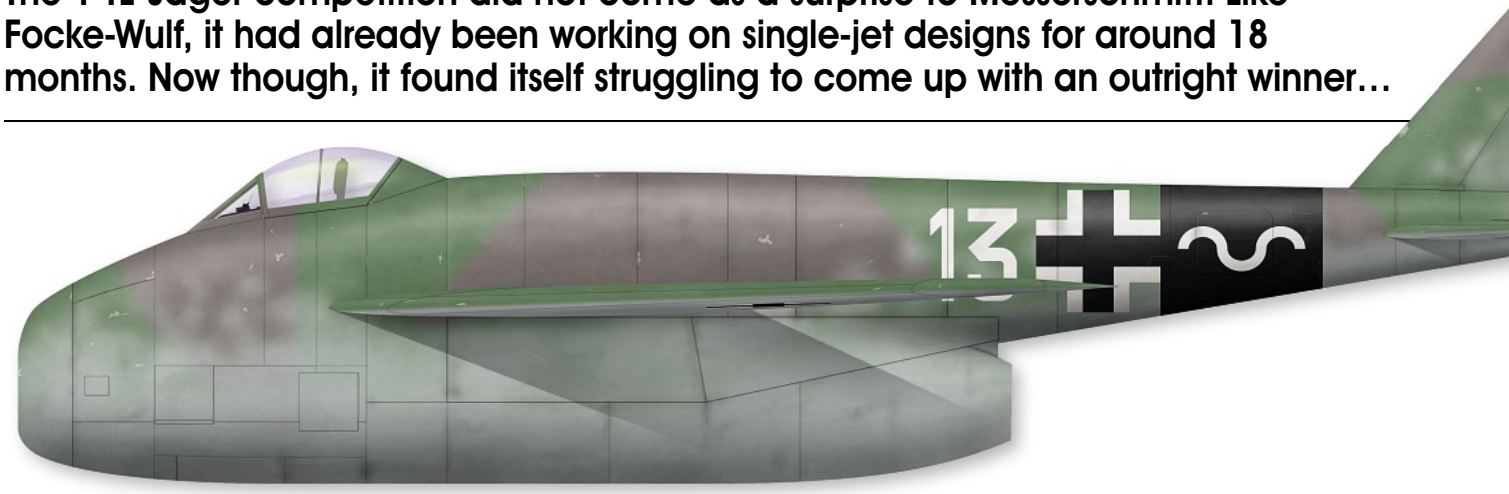


ABOVE: Three shots of what appears to be the EF.128 being wind tunnel tested – but look closely and you can see a more pointed nose and more bulbous cockpit. Presumably different configurations were tried during the design process but all drawings of this process are lost. via author

P.1101 (and P.1106)

1-TL-Jäger – Messerschmitt part 1

The 1-TL-Jäger competition did not come as a surprise to Messerschmitt. Like Focke-Wulf, it had already been working on single-jet designs for around 18 months. Now though, it found itself struggling to come up with an outright winner…



ABOVE: The experimental version of the Messerschmitt P.1101 as it might have appeared as a production combat machine. Art by Chris Sandham-Bailey

The only jet aircraft in service anywhere in the world when the requirements for the 1-TL-Jäger were issued was Messerschmitt's Me 262.

The firm had learned some hard lessons during the twin-engine aircraft's design and development and was now able to apply real world data to its single-engine designs.

Work on these had begun at the start of 1943 with the P.1092. This was an attempt to create a multirole fighter with a Jumo 004 engine built into the lower fuselage and fed by an intake just below the aircraft's nose.

None of these was particularly successful, primarily due to the low power of just one 004 – the Me 262 had two – but also because the designers struggled with the same problems faced by Focke-Wulf, such as where to put the undercarriage and how to come up with an aerodynamic form that suited an engine mounted within the fuselage.

By July 1943, the P.1092 had been abandoned in favour of another single-jet project, the P.1095. This was similar to Focke-Wulf's Baubeschreibung Nr. 264 aircraft – with the engine beneath rather than within the fuselage. It would have shared many parts with the Me 309 piston-engine fighter and the Me 262 to keep costs down but this too was abandoned towards the end of 1943.

During the first half of 1944, Messerschmitt concentrated its efforts on developing the Me 262 but when the 1-TL-Jäger contest came along the P.1092 and P.1095 project files were reopened.

Messerschmitt's first submission to the competition, made during the September 8-10 meeting, the P.1101, had an all-metal fuselage and the intakes for its single centrally mounted HeS 011 engine were built into the wing roots on either side of the cockpit.

The nose was blunt and instead of the usual tail fin it had a V-tail arrangement.

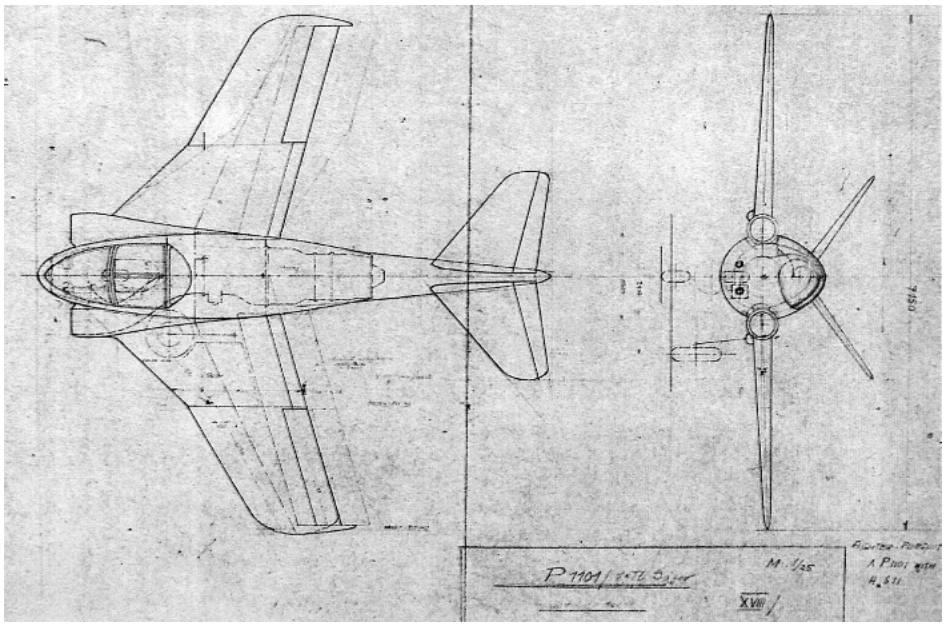
After the September meeting, however, the P.1101 was significantly revised. A nose intake was adopted, and the V-tail was replaced with a conventional fin.

With this more straightforward design in hand, Willy Messerschmitt instructed his staff to build an experimental aircraft – a flying test bed – based on it.

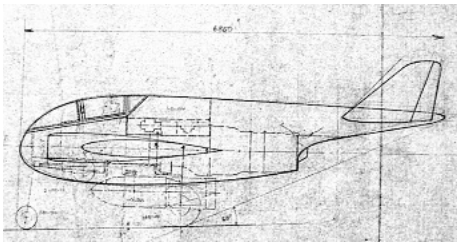
A company report dated November 10, 1944, goes into great detail outlining the specifications of the experimental aircraft and gives details of different roles that a series production version would be capable of fulfilling – such as day fighter, night fighter and interceptor, all optionally equipped with either four X-4 or two Hs 298 air-to-air missiles.

Entitled Projektübergabe P.1101, it begins: "The P.1101 project is designed as a single-seat fighter with a TL unit, namely as final solution with HeS 011.

"To bring the aircraft to the testing stage as quickly as possible, and to accelerate the start of production, the designers were charged with using as many components and assemblies without modification, or with only small changes, as possible from the Me 262 production aircraft.



ABOVE: The P.1101 as it was entered for the 1-TL-Jäger contest in September 1944. via author



ABOVE: Side view of the Messerschmitt P.1101 1-TL-Jäger. via author

"The first V-plane is to be built as an experimental aircraft, in other words during trials extensive changes can be made to the wings, fuselage and tail.

"The experimental aircraft can be the basic pattern for the series production version but need not necessarily be. This is because further research is needed on area ratios, on the various items of equipment in their individual stages of development and on the flight performance issues of highly swept wings and tail and their behaviour at supercritical Mach numbers.

"The demands being placed on the production version need to be considered in the construction of the first V-planes. The project presentation outlines the details of the experimental aircraft using the known claims for the series production version.

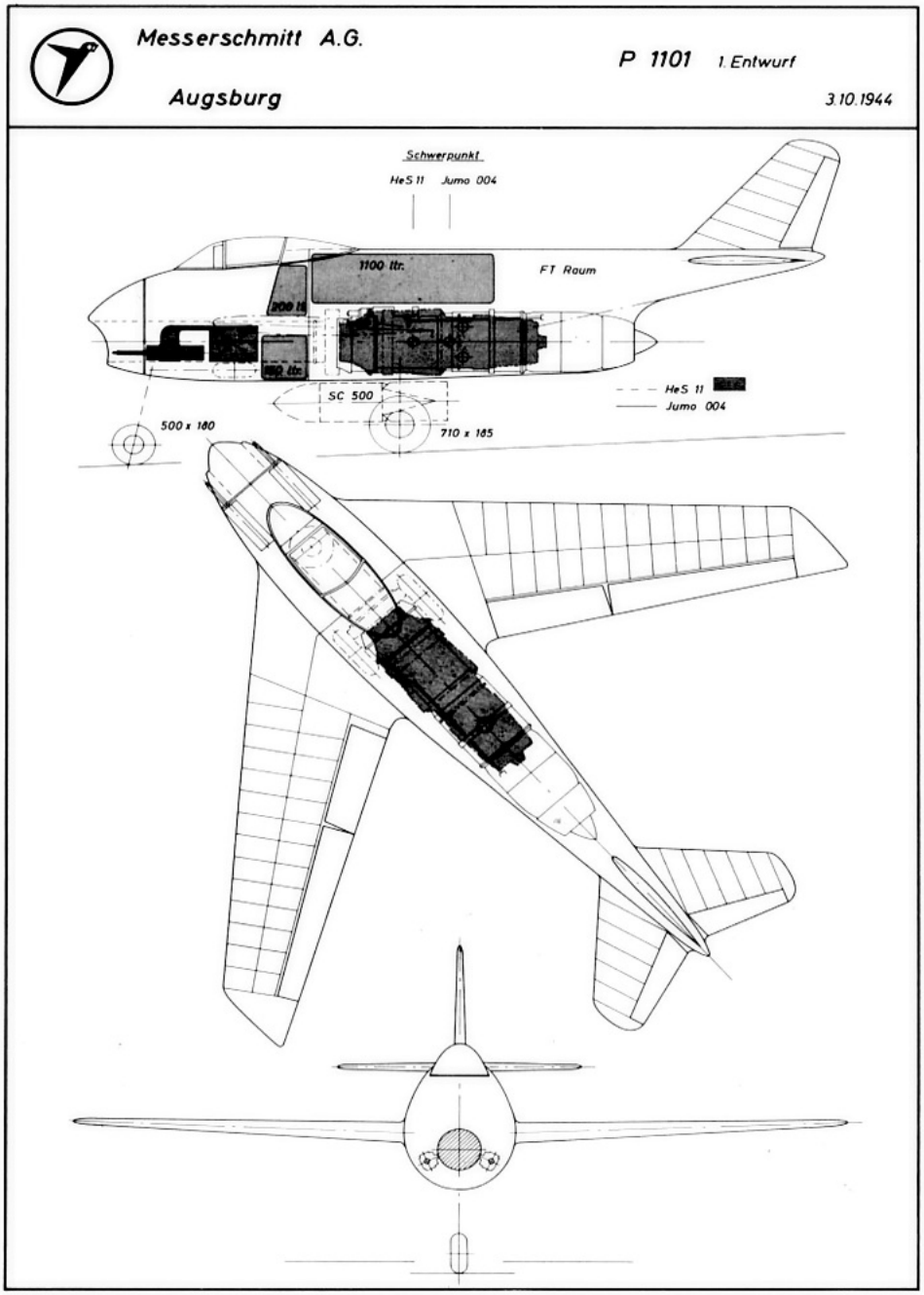
"However, these are constantly being updated using the results from the testing of experimental aircraft and from completed investigations into equipment and its installation. For best performance, it is absolutely necessary that in the design and manufacture the highest level is reached in aerodynamic form.

"The work already carried out by Messerschmitt aircraft is not yet sufficient to achieve maximum speeds."

More details of the experimental aircraft are then given – it was to have an internal fuselage structure "built on the Me 262" and Me 262 wings to see how they behaved without engine nacelles attached. It was expected that "the close examination and testing of the tail and wings will result in changes during the transition to series production".

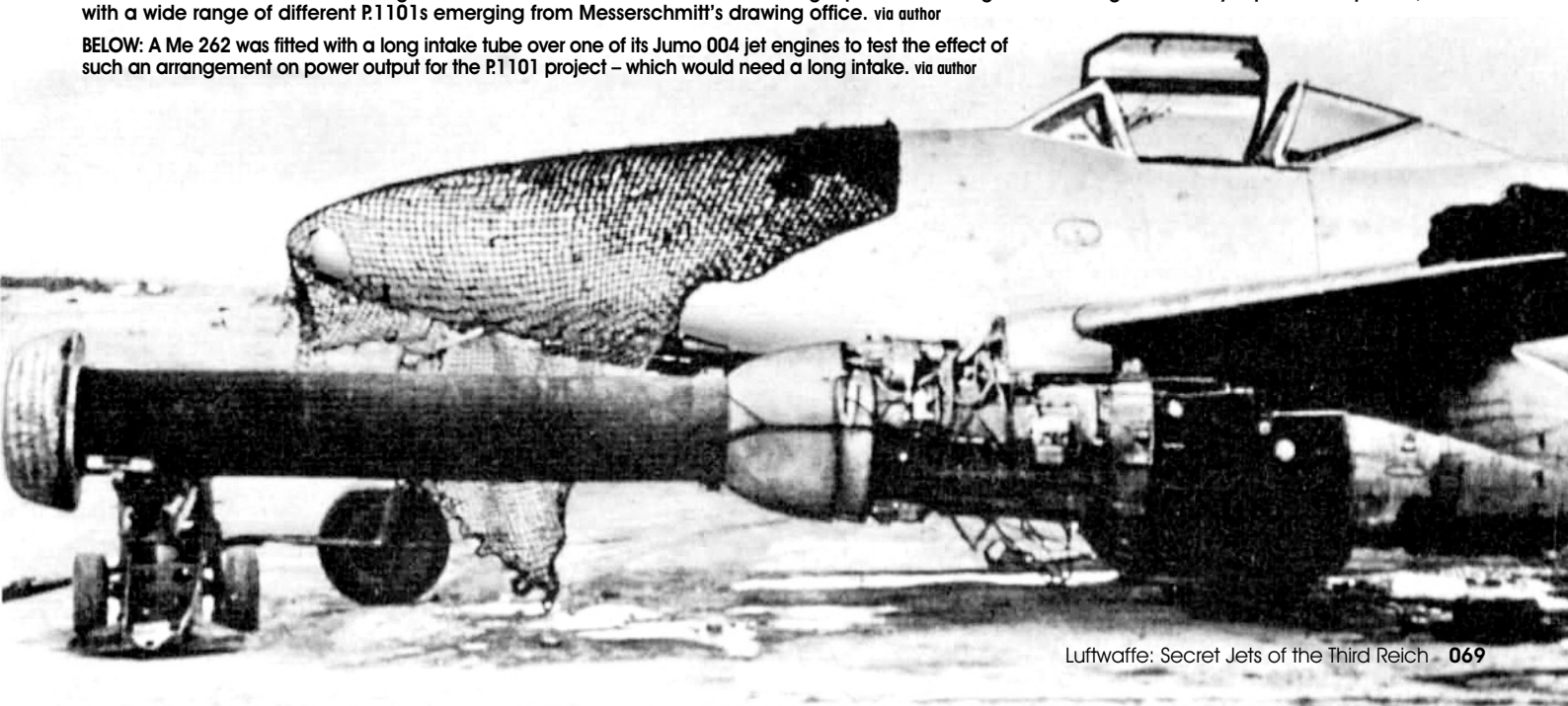
The experimental aircraft was also to have one particularly unusual feature: "The wing must be rotatable about the spar connection point so that a sweep of the wing with respect of 35 and 45 degrees is possible. The V-angle has to be changeable between +2 and –3 but the normal V-position is 0."

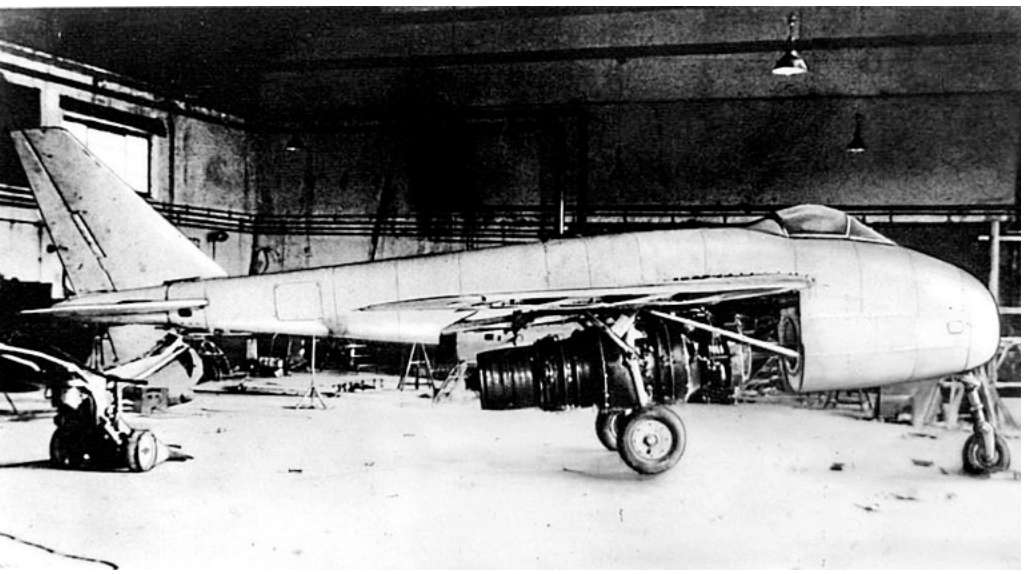
Other features of the wings were also to be altered – the outer aileron was to be extended



ABOVE RIGHT: The P.1101 as redesigned less than a month after the first 1-TL-Jäger pitch. The design went through extremely rapid development, with a wide range of different P.1101s emerging from Messerschmitt's drawing office. via author

BELOW: A Me 262 was fitted with a long intake tube over one of its Jumo 004 jet engines to test the effect of such an arrangement on power output for the P.1101 project – which would need a long intake. via author





ABOVE: The Messerschmitt P.1101 experimental aircraft as found at the company's Oberammergau facility in 1945. The rear wheels appear to be floating because the tail is jacked up. via author

over the span of the edge cap and the inner aileron was to be omitted and replaced by a landing slat. Alterations to slots were also possible. Smoothness of wing surfaces and of jet intake interior were stressed.

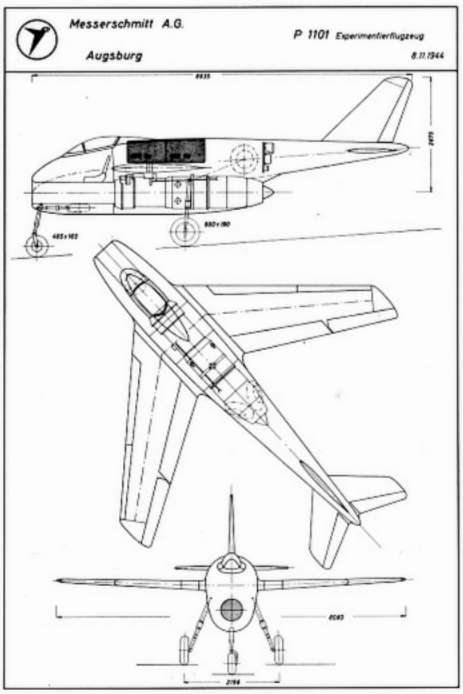
The experimental aircraft was also designed to accommodate both the Jumo 004B, since this would be used to power it initially, and the HeS 011 when this later became available. A skid was to be fitted beneath the engine too so that it would be protected in the event of an emergency landing.

While the series production version was to have a standard armament of two MK 108s, the experimental version had armament omitted and "armour does not apply to the experimental aircraft but a later installation option should be available".

Basic equipment was to be fitted to the experimental aircraft since it had not yet been decided what equipment the production version should carry. This included: blind flying instruments, engine monitoring instruments, a remote compass, "FuG 16 (taken from Me 262)", a 3000W generator to be mounted on the engine and a flow of warm air extracted from the engine for defogging viewing panes in the cockpit.

A CHANGE OF PLANS

Before the next meeting to discuss the 1-TL-Jäger, on December 15, Messerschmitt decided to submit another design alongside the P.1101 – the P.1106. This was an advanced update on the final version of the P.1092 which had been drafted in July 1943 but also bore some similarities to the P.1101.

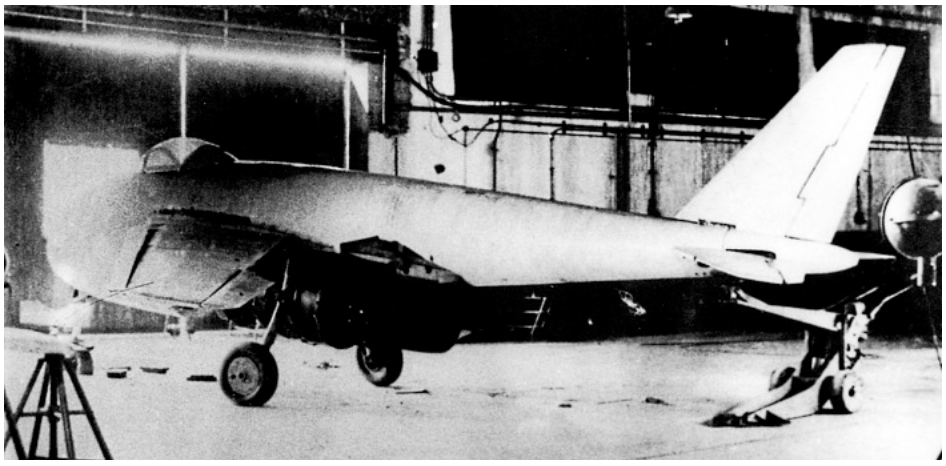


ABOVE: A view of the P.1101 experimental aircraft's slightly damaged nose after it was captured by the Americans. The writing is presumed to be theirs. via author

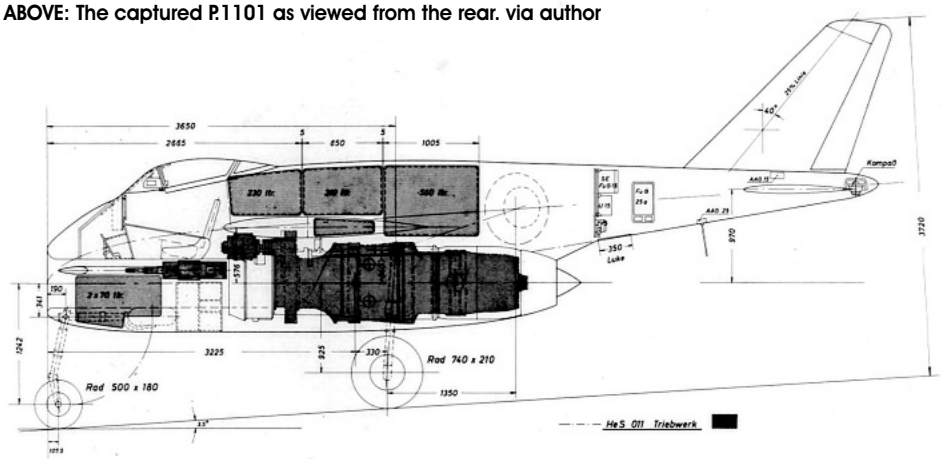
It had a nose intake and fuselage mounted engine but instead of having the cockpit at the front of the fuselage (P.1101) or in the centre (P.1092), it was positioned far to the rear. This odd shape apparently gave the best aerodynamic performance Messerschmitt had yet achieved.

Since no decision was made in December however, the competition continued and both the P.1101 and P.1106 were reassessed and revised. Despite providing an exceptionally streamlined shape, the P.1106 also presented problems in terms of visibility – the pilot's view being somewhat obstructed by the huge stretch of fuselage in front of him and by the wings blocking his visibility forward and down.

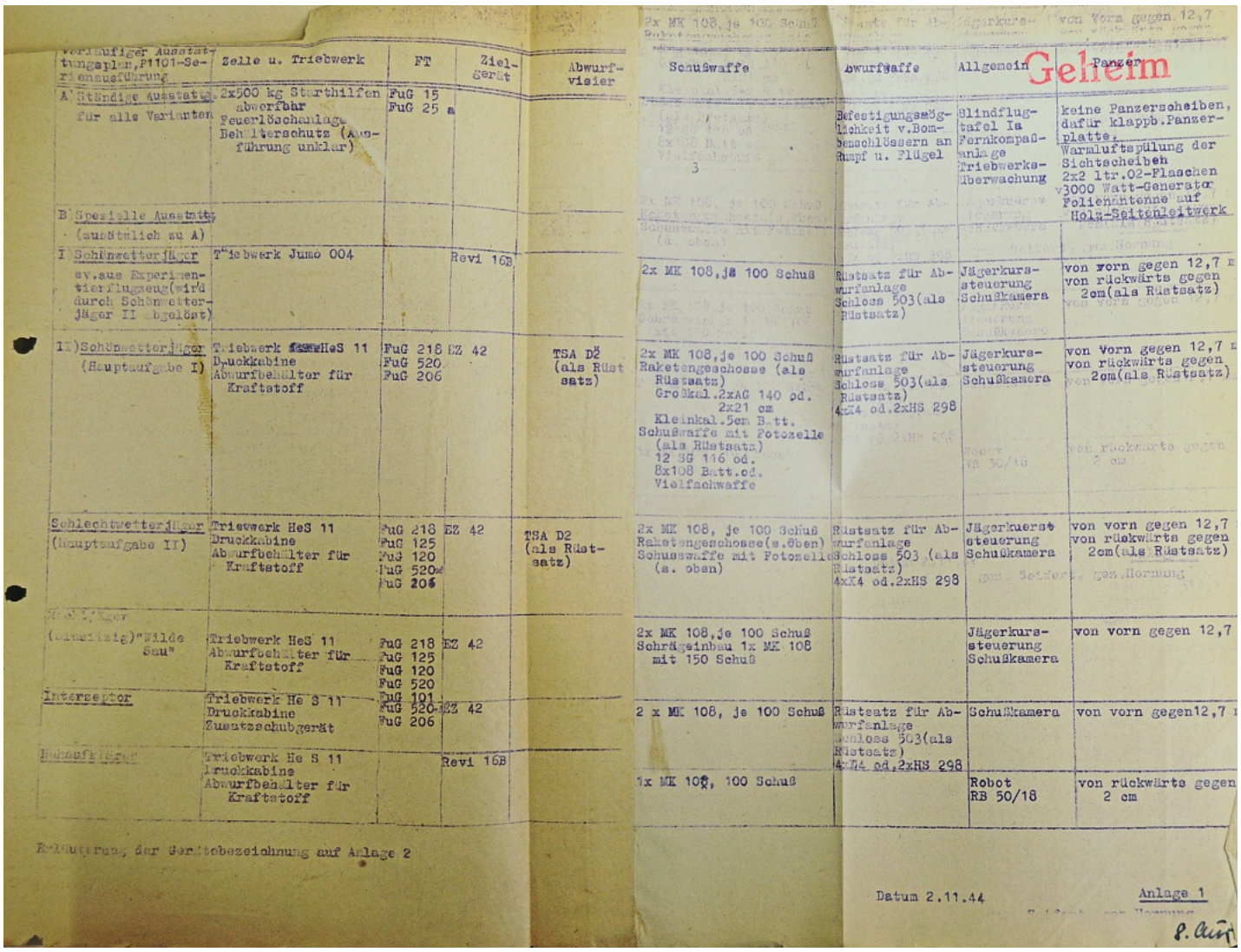
On this basis, the P.1106 was eventually dropped ahead of the February 27-28 meeting and the P.1101 went forward alongside another two new designs – the P.1110 and P.1111.



ABOVE: The captured P.1101 as viewed from the rear. via author



ABOVE AND LEFT: By November, Messerschmitt had changed tack with the P.1101, offering it as a prototype cum work in progress for a future production version. via author



vorläufiger Ausstattungsplan, P.1101-Serienausführung	Zelle u. Triebwerk	FT	Zielgerät	Abwurfvisier	Schußwaffe	Abwurfwaffe	Allgemein	Panzer
A Ständige Ausstattung für alle Varianten	2x500 kg Starthilfen abwerfbar Feuerlöschanlage Behälterschutz (Ausführung unklar)	FuG 15 FuG 25 a				Befestigungsmöglichkeit v. Bombenschlössern an Rumpf u. Flügel	Blindflugtafel Ia Fernkompaßanlage Triebwerksüberwachung	keine Panzerscheiben, dafür klappb. Panzerplatte. Warmluftspülung der Sichtscheiben 2x2 ltr. O2-Flaschen 3000 Watt-Generator Folienantenne auf Holz-Seitenleitwerk
B Spezielle Ausstattung (ausschließlich zu A)								
I Schönwetterjäger ev. aus Experimentierflugzeug (wird durch Schönwetterjäger II abgelöst)	Triebwerk Jumo 004		Revi 16B		2x MK 108, je 100 Schuß	Rüstsatz für Abwurfanlage Schloss 503 (als Rüstsatz)	Jägerkurssteuerung Schußkamera	von vorn gegen 12,7 von rückwärts gegen 2cm (als Rüstsatz)
II) Schönwetterjäger (Hauptaufgabe I)	Triebwerk HeS 11 Druckkabine Abwurfbehälter für Kraftstoff	FuG 218 FuG 520 FuG 206	DZ 42	TSA D2 (als Rüstsatz)	2x MK 108, je 100 Schuß Raketengeschosse (als Rüstsatz) Gro.Kal. 2xAG 140 od. 2x21 cm Kleinkal. 5cm Batt. Schußwaffe mit Fotozelle (als Rüstsatz) 12 SG 116 od. 8x108 Batt. od. Vielfachwaffe	Rüstsatz für Abwurfanlage Schloss 503 (als Rüstsatz) 4xX4 od. 2xHS 298	Jägerkurssteuerung Schußkamera	von vorn gegen 12,7 von rückwärts gegen 2cm (als Rüstsatz)
Schlechtwetterjäger (Hauptaufgabe II)	Triebwerk HeS 11 Druckkabine Abwurfbehälter für Kraftstoff	FuG 218 FuG 125 FuG 120 FuG 520 FuG 206	EZ 42	TSA D2 (als Rüstsatz)	2x MK 108, je 100 Schuß Raketengeschosse (s. oben) Schußwaffe mit Fotozelle (s. oben)	Rüstsatz für Abwurfanlage Schloss 503 (als Rüstsatz) 4xX4 od. 2xHS 298	Jägerkurssteuerung Schußkamera	von vorn gegen 12,7 von rückwärts gegen 2cm (als Rüstsatz)
(einsitzig) "Wilde Sau"	Triebwerk HeS 11 Abwurfbehälter für Kraftstoff	FuG 218 FuG 125 FuG 120 FuG 520	EZ 42		2x MK 108, je 100 Schuß Schrägeinbau 1x MK 108 mit 150 Schuß		Jägerkurssteuerung Schußkamera	von vorn gegen 12,7
Interceptor	Triebwerk He S 11 Druckkabine Zusatzschubgerät	FuG 101 FuG 520 FuG 206	EZ 42		2 x MK 108, je 100 Schuß	Rüstsatz für Abwurfanlage Schloss 503 (als Rüstsatz) 4xX4 od. 2xHS 298	Schußkamera	von vorn gegen 12,7
Jagdaufklärer	Triebwerk He S 11 Druckkabine Abwurfbehälter für Kraftstoff		Revi 16B		1x MK 108, 100 Schuß		Robot RB 50/18	von rückwärts gegen 2 cm

Erläuterung der Gerätebezeichnung auf Anlage 2

Datum 2.11.44 Anlage 1

Geheim

ABOVE: Chart from November 2, 1944, report on the P.1101, showing equipment for the various different versions envisioned. GDC

The experimental P.1101 aircraft had been completed since January and now stood in a hangar at Oberammergau awaiting delivery of a Jumo 004B engine so that test flights could begin.

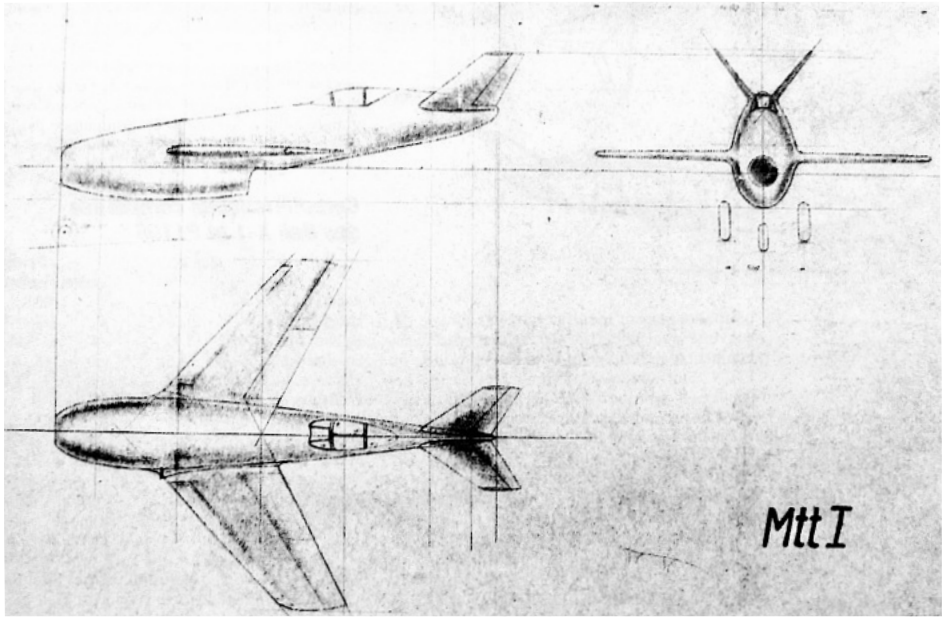
This was not mentioned in the general outline notes prepared in advance of the February meeting however. The P.1101 is described simply as: "Cantilever swept back middle wing aircraft with engine in stern of fuselage. Abnormal arrangement of stabilisers. Wings: two-part wood cased wings with 40 degree sweep back. Slot with varying percentage depth at the leading edge. Landing flaps as plain flaps.

"Fuselage: the forward part of the fuselage contains the air conduit for the engine, armament, nose gear and pressure proof cabin with pilot seat. The middle part of the fuselage contains the fuel tank and the undercarriage at the top and the engine below. The end of the fuselage is cone shaped, supports the stabiliser, and contains the equipment."

Armament is given as two MK 108s with 100 rounds each "as normal armament. Additional two MK 108s with 100 rounds each provided".

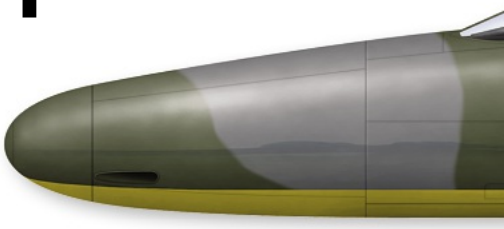
Against Messerschmitt's other two designs, however, the P.1101's projected performance had begun to look decidedly average and despite the state of readiness achieved with the experimental aircraft, no development contract was forthcoming.

After this decision, it seems that any urgency previously attached to finding an engine for the experimental aircraft evaporated and it was left to languish, incomplete, until it was captured by the Americans at the end of April 1945. ●



ABOVE: Three-view of the unusually arranged Messerschmitt P.1106 from a January report on the 1-TL-Jäger competition. Note that at this stage the P.1106 was being referred to as 'Messerschmitt I'. The P.1110 was the 'Messerschmitt II' and the P.1101 was the 'Messerschmitt III'. The firm's entries were referred to by their project numbers in the February report. via author

P.1110, P.1111 (and P.1112)



1-TL-Jäger – Messerschmitt part 2

The flaws identified in the P.1106 design convinced Messerschmitt that it could not sit alongside the P.1101 as the company's second entry to the 1-TL-Jäger competition. Therefore, the latest fruits of its design and development programme were hastily prepared for submission during the final round.

Designing the 1-TL-Jäger had been a process of continual evolution for Messerschmitt and this continued on into 1945 as the competition approached its crunch meeting of the EHK on February 27-28, 1945.

At the last minute, Messerschmitt withdrew the radical P.1106 and replaced it with two new designs which promised to address its problems and offer even better aerodynamic performance – the P.1110 and P.1111. In these, Messerschmitt presented perhaps the two most advanced aircraft designs the world had seen up to this point.

P.1110

The P.1110 had the same wooden swept-back wings as the last revision of the P.1101 but with wing root leading edge extensions designed to increase the angle of incidence. The turbojet was mounted centrally within the fuselage and fed by two intakes on the sides of the fuselage.

An early version of the P.1110 had featured a dorsal intake but this unusual feature was deleted by the time of the meeting. Its fuselage was all-metal and within its nose were housed three MK 108s. Messerschmitt stated that it would be possible to expand this to five MK 108s. Like the company's other designs, the P.1110 featured a tricycle undercarriage and a pressure cabin for the pilot.

The fuel tanks were all within the fuselage, rather than in the wings, and the tail was swept back at an angle of 40 degrees. The report also notes that it "can be replaced later by V-tail".

Regarding the engine it states: "The engine is situated in the stern. Air is conducted to the engine through inlets in the side of the fuselage.

"The boundary layer running against the long forward part of the fuselage is taken in through a supercharger coupled to the turbo through two or more slots in the curved inlet."

The 1500 litre fuel tank was armoured and sat in the centre part of the fuselage between the pilot's cabin and the turbojet. The report states: "The Messerschmitt cell tanks which are provided can be exchanged for the normal storage tanks."

Its sleek shape no doubt helped to make the P.1110 the fastest aircraft design entered for the 1-TL-Jäger competition, and the only one to hit the magic 1000kph (621mph) mark. Its rate of climb was only average, however, and it was heavy – almost the heaviest aircraft, just behind the Focke-Wulf I.

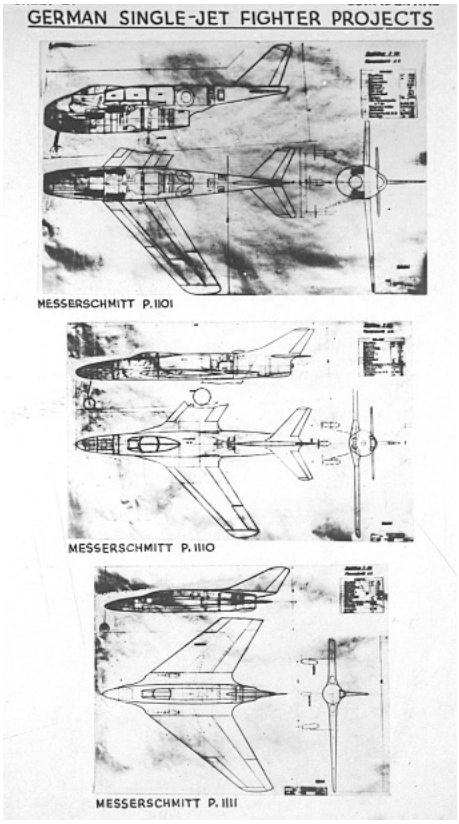
P.1111

Reminiscent of the Me 163 in appearance and undoubtedly building upon the aerodynamic research carried out by Alexander Lippisch during his years at Messerschmitt, the tailless P.1111 nevertheless had entirely new wings.

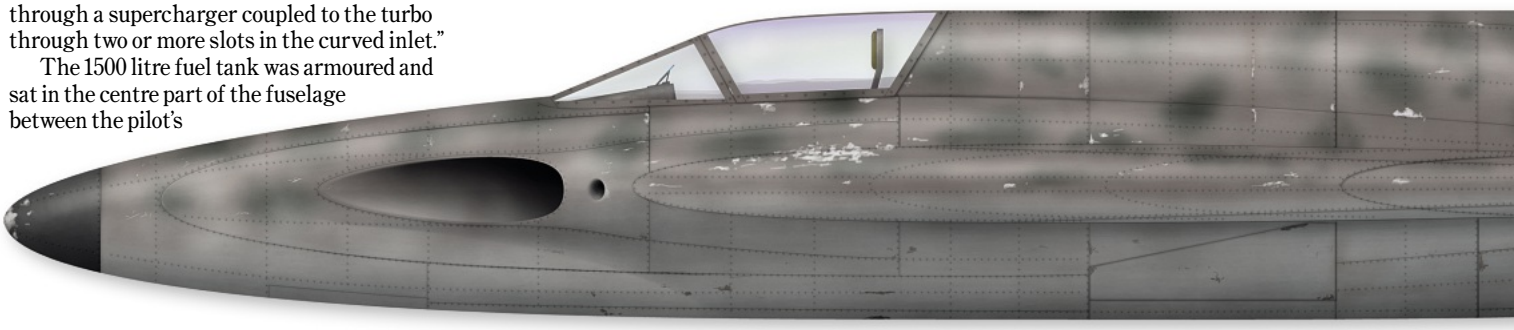
These large swept-back units contained unprotected fuel tanks with an overall capacity of 1500 litres. Like the P.1110, its fuselage was all-metal but housed only two MK 108s in its nose – with an option to fit a further two in the wing roots just outboard of the uncomplicated engine intakes. There was a pressurised cockpit but no ejection seat.

As the second fastest design submitted to the contest and the design with the best rate of climb, Messerschmitt held the P.1111 in high regard but felt that more could still be achieved by fine tuning it.

When none of the company's three designs was able to secure a development contract through the 1-TL-Jäger competition, it moved onto another project that was intended to be the ultimate embodiment of everything that had been learned up to that point about aerodynamic design for superior high performance.



ABOVE: The three Messerschmitt designs submitted for the end of February 1-TL-Jäger meeting – the P.1101, P.1110 and P.1111. Here the original German drawings have been copied into British A.I.2(G) report no. 2369. Note the updated layout of the P.1110, now with fuselage-side intakes, from the earlier drawing. TNA



BELOW: The P.1110 was perhaps the most 'modern' looking German project of the war and it is easy to imagine that, once built, examples of it might have fallen into British hands. This 'captured' aircraft has been given the serial VH529. Art by Chris Sandham-Bailey

P.1112

It is debatable whether Messerschmitt ever expected the P.1112 to enter production. Instead, as the company's last project of the war, it was an exercise in refined aerodynamics which saw what had started out as the P.1111 undergo numerous changes in almost every area – from intakes to wings to tail.

The shape of the cockpit, positioned in the aircraft's nose, was established early on however, and work was begun on a mock-up of it.

The British summary of the project in German Aircraft: New and Projected Types reads: "The P.1112 was designed to correct some of the faults which became apparent after study of the P.1111.

"The wing area was reduced to 236.5sq ft since it was felt that the wing loading could be increased. The pilot's cockpit is situated at the extreme nose of the aircraft and 2 x MK 108 guns are fitted in the wing.

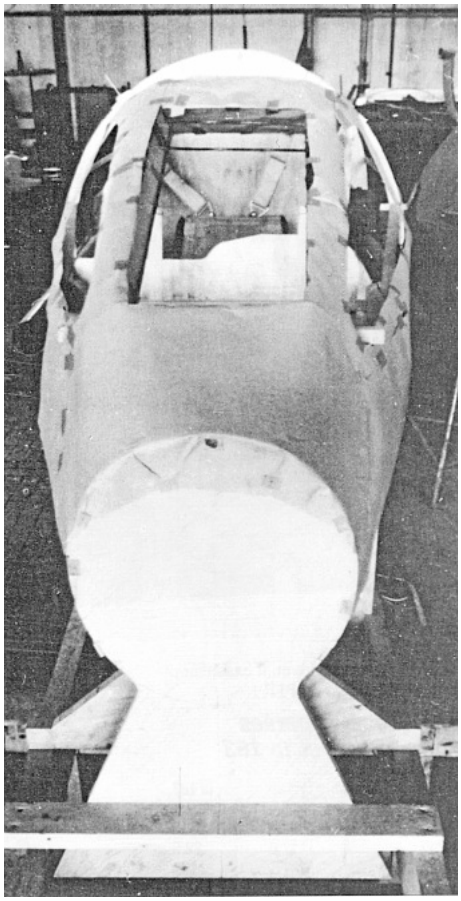
"The remainder of the design closely resembles the P.1111. Performance calculations were not completed."

Interviewed on September 7, 1945, by the British, the head of Messerschmitt's project office, Woldemar Voigt, said: "P.1101, P.1106, P.1110, P.1111, P.1112. A project investigation of the single engined jet fighter was being carried out. The project drawings are known here, I assume.

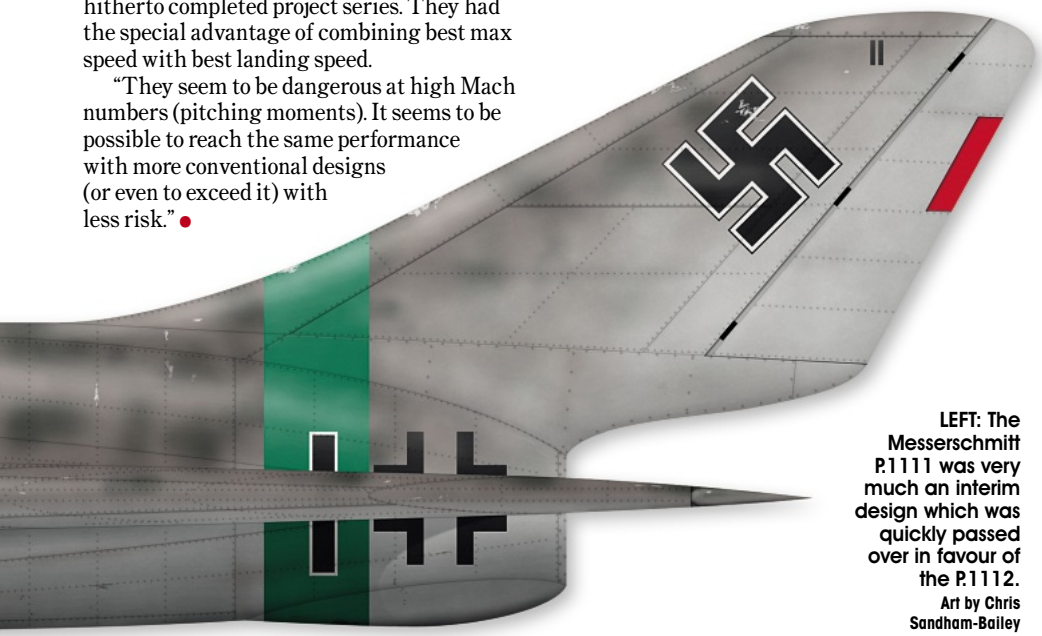
"A final conclusion had not been drawn until the end of the war; the results secured by that time were: a speed of 1000kph (620mph) is obtainable and had been guaranteed to the government.

"The tailless designs P.1111 and P.1112 showed the best performance out of the hitherto completed project series. They had the special advantage of combining best max speed with best landing speed.

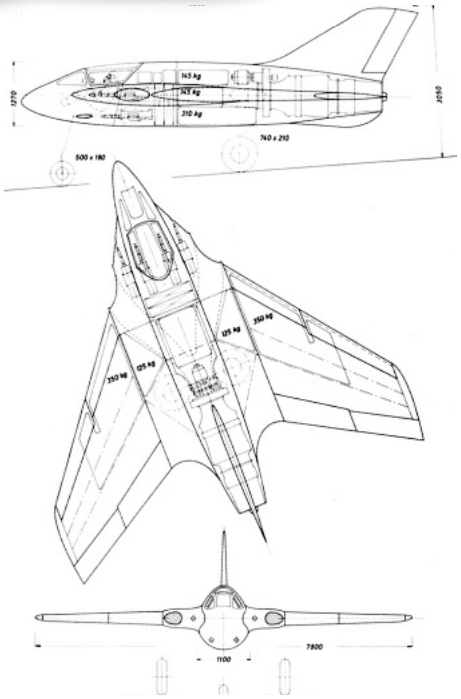
"They seem to be dangerous at high Mach numbers (pitching moments). It seems to be possible to reach the same performance with more conventional designs (or even to exceed it) with less risk." ●



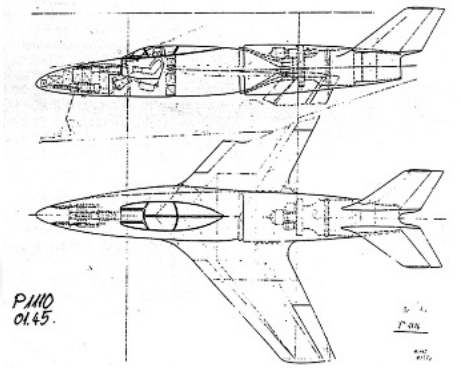
ABOVE: A forward view of the P.1112 cockpit mockup being worked on by Messerschmitt at its Oberammergau facility as the war came to an end. via author



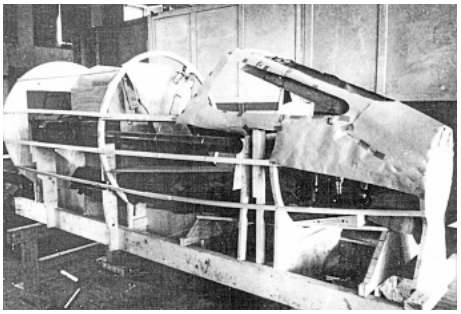
LEFT: The Messerschmitt P.1111 was very much an interim design which was quickly passed over in favour of the P.1112. Art by Chris Sandham-Bailey



ABOVE: A postwar redrawing of the Messerschmitt P.1112 design from March 3, 1945. Work on the type continued right until the end of the war. It was the company's last wartime fighter project. via author



ABOVE: The Messerschmitt P.1110 as it looked in January 1945, with narrow semi-circular engine intakes both above and below the fuselage. via author



ABOVE: Side view of the P.1112 cockpit mockup. via author

Cheap, basic and slow

Volksjäger (September 1944)

The aim of the 1-TL-Jäger competition was to create a new fighter for the Luftwaffe's trained pilots. But what if a stripped back single-jet fighter could be built that was cheap, basic and so easy to fly that anyone could do it? It would become a people's fighter…

The story of the Volksjäger requirement of September 10, 1944, is remarkable from beginning to end.

It is uncertain exactly whose idea it was to launch a second single-jet fighter competition before the presentations for the 1-TL-Jäger had even ended but whoever it was had a keen sense of how that contest was going to progress – slowly.

They also evidently had a good idea of just how little time might be left to bring such a project to fruition before the necessary resources were no longer available to Germany.

Starting on Friday, September 8, 1944, representatives of Blohm & Voss, Focke-Wulf, Heinkel and Messerschmitt had been discussing the latter three firms' pitches for the 1-TL-Jäger competition – Focke-Wulf's Nr. 280 design, Heinkel's P.1073 and Messerschmitt's P.1101.

The meeting continued on the Saturday and the Sunday without any firm conclusion being reached, as has already been related, but just before noon on the final day a message was sent simultaneously to Arado, Blohm & Voss, Fieseler, Focke-Wulf, Heinkel, Junkers, Messerschmitt and Siebel outlining a new requirement.

This called for a fighter powered by a single BMW 003 engine that could reach a maximum speed of 750kph (466mph) and have an endurance of 30 minutes at full throttle. It also had to be able to operate from poor airfields and come equipped with two MK 108s or two MG 151s.

This was a seemingly much more achievable set of objectives compared to those of 1-TL-Jäger, which called for 1000kph (621mph) and a full hour's endurance with a single HeS 011 engine. There were two major complications however.

ABOVE: A rare picture of the Volksjäger competition winner in flight, albeit with a British pilot at the controls. Heinkel's P.1073 became the He 162 and was just entering service as the war ended. via author

The first was that wood and steel were to be used as much as possible during construction of the Volksjäger, and secondly, whereas the companies had had two months to prepare their 1-TL-Jäger designs, they were given just four days to prepare them for the first Volksjäger presentation.

Three companies decided against tendering – Fieseler, Messerschmitt and Siebel – but the remainder each fielded at least one new design on September 14, 1944.

ARADO E.580

While its Ar 234 reconnaissance aircraft was taking shape in early to mid-1943, the Arado company had carried out some research on potential jet fighter layouts. At least three designs are believed to have been produced, each utilising a long slender fuselage similar to that of the Ar 234 but with swept wings.

Among these designs was what is commonly known today as the TEW 16/43-15. TEW was the internal company designation for its technical design office – typically written on documents as TEW-Bra, the latter part being its location, Brandenburg – and

16/43-15 appears to be the drawing number rather than the name of a particular design as such.

TEW 16/43-15 shows a mixed propulsion design with a rocket engine exhausting through the rearmost part of the tail. The engine, however, was positioned on top of the fuselage. It had an unusual intake that partially shrouded the rear of the cockpit. The tail was split with twin rudders to prevent interference from jet wash.

It was, however, only part of a larger design study never intended for submission to the RLM. In addition, since its nationalisation and the wholesale use of its resources to mass produce the aircraft of other companies, Arado's 'glory days' of fighter design had long since ended.

When it was asked to come up with a single-jet fighter design utilising only basic materials and the relatively low-powered BMW 003, its design office was forced to adapt the TEW 16/43-15 as a jet-only fighter by removing most of its long tail, adding conventional wings and making the rest of it fit as appropriate.

A British report on the E.580 noted that "the nose is extremely long" and in comparison to the other designs offered it is – betraying the fact that the original's nose underwent much less of a redesign than the rest of it.

Following the announcement of the requirements on September 10, Arado's design was ready in just two days – by September 12.

BLOHM & VOSS P.211

During its design studies for its first 1-TL-Jäger entry, the P.209, Blohm & Voss had explored much more conventional layouts before settling on a radical one. With its next design, the P.210, the company went for a tailless 'bat wing' design but modified and refined both the cockpit layout and the shape of the nose intake.

The Volksjäger concept might almost have come out of a Blohm & Voss brochure – since the company had been trying to emphasise how simple, effective and above all cheap its single-jet fighters would be to produce.

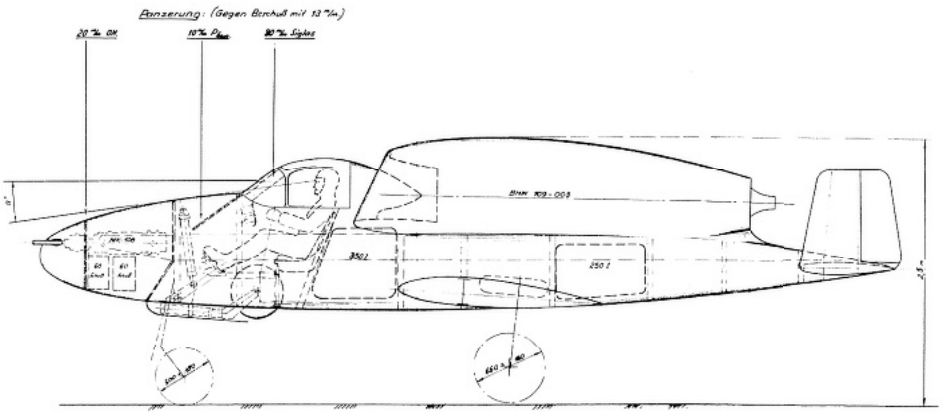
In order to meet the requirement, the company simply took the cockpit and main fuselage of the P.210 and married them to the wings and tail of one of its more conventional P.209 layouts.

This resulted in perhaps the most aerodynamically advanced of the Volksjäger entries. Where the Arado design had a calculated maximum speed of 465mph, falling just shy of the requirement, the P.211 was assessed as being capable of 536mph with exactly the same engine. Rate of climb was also significantly better.

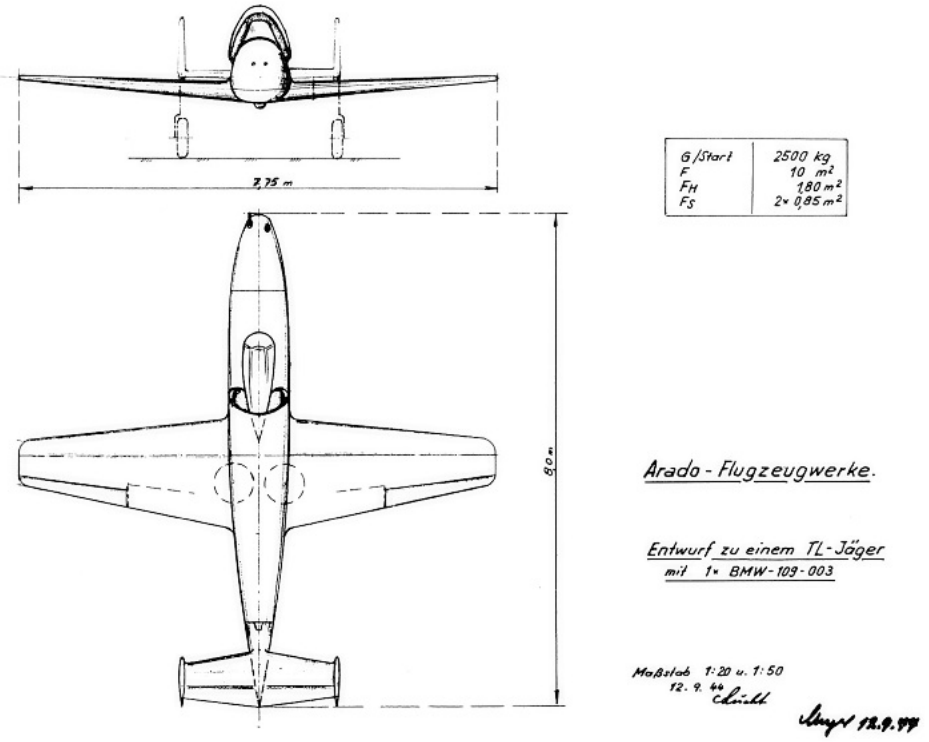
The secret of the P.211's success lay in its swept back wings and a tubular spar at its heart made of very thin steel. All of the aircraft's major components were attached to the structural spar – including the wings, turbojet unit, and tail. The tailplane itself was unusually shaped – having a swept leading edge but a straight trailing edge.

FOCKE-WULF VOLKSFLUGZEUG AND EINHEITS-T-L JÄGER

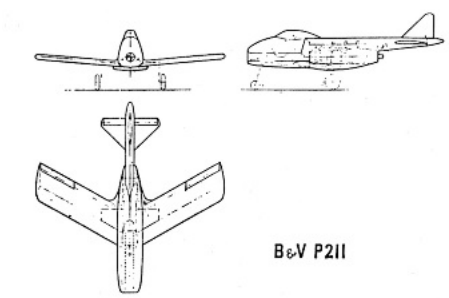
Despite the tight timescale, Focke-Wulf came up with a highly advanced design to rival that of Blohm & Voss – based on elements of previous and ongoing designs. The Volksflugzeug had a



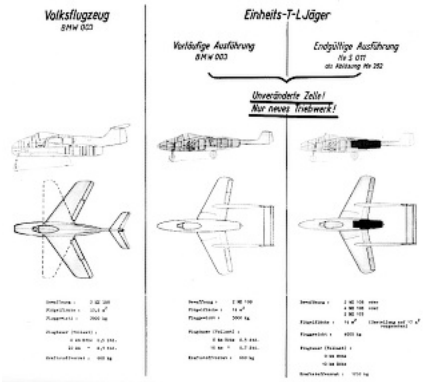
ABOVE: Arado had once been an important supplier of fighters to the Luftwaffe and hoped to be so again with this, the E.580. The design featured a long nose and the jet intake arrangement was unconventional at a time when speed and straightforward simplicity were most highly prized. via author



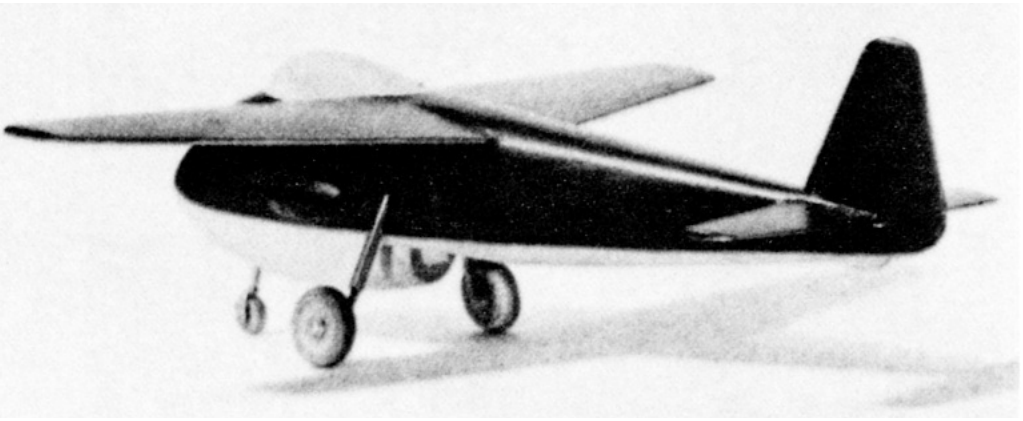
ABOVE: The layout of the Arado E.580 echoed that of the Heinkel bid – with a similar tail unit, wings and engine arrangement – but Heinkel had already spent months honing its design for the 1-TL-Jäger competition. via author



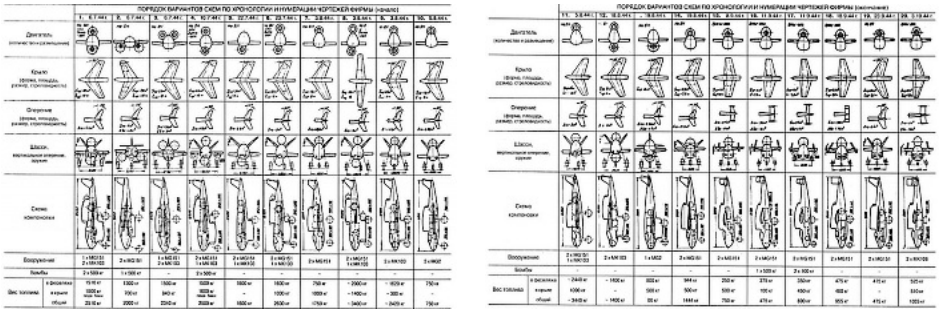
ABOVE: Blohm & Voss's Volksjäger entry was the striking P.211. It boasted advanced features, such as a swept wing and internal turbojet – but Volksjäger was not about technological supremacy. A revised B&V design with straight wings and a redesigned, simpler, fuselage found favour but was ultimately rejected. TNA



ABOVE: With a decidedly lukewarm reception being given to its 1-TL-Jäger entry on the day that the Volksjäger contest was announced, Focke-Wulf decided to repackage it and try again. Its proposal envisioned its twin-boom Nr. 280 design being fitted with the weak BMW 003 engine to begin with and then simply re-engined when the HeS 011 came along. The Nr. 280 met with the same response in Volksjäger that it had had in 1-TL-Jäger – rejection. Unfortunately, this overshadowed its alternative design – the surprisingly good Focke-Wulf Volksflugzeug, pictured left in the drawing above. via author ▶



ABOVE: Little is known about Junkers' Volksjäger Projekt and what is known comes from a very basic report featuring photographs of the model pictured here. The position of its turbojet, under the nose, may well have resulted in its dismissal from the contest – since the Volksjäger would be expected to operate from improvised front line airfields where the chances of a low intake picking up debris were high. via author



ABOVE: A chart showing the evolution of the P.1073 design, through its beginnings as a design study, to its entry in the 1-TL-Jäger contest of July and August, to its acceptance as the Volksjäger winner in October 1944. It is unclear whether the chart was produced for the Russians by ex-Heinkel staff after the war, or was a document captured after designers fled Vienna in 1945 and then annotated in Russian. via Polygon

than that of the company's Nr. 279 1-TL-Jäger (what would end up as the Ta 183) and the swept 'T' sat atop a tail that was similar to the lower half of the one fitted to the Ta 152.

Two wing options were available – one swept and one with a straight leading edge and forward-swept trailing edge, the latter being to account for the comparatively low thrust of the BMW 003, particularly at low speed. Loaded weight was 2900kg and endurance was half an hour at sea level or 42 minutes at 33,000ft.

Six days after the initial September 14 presentation of designs, on September 20, Focke-Wulf presented another proposal for the Volksjäger competition. By now, it had had over a week to reflect on the less than positive reception given to its Nr. 280 1-TL-Jäger design during the September 8-10 presentation and decided to take a different tack.

A pamphlet was produced showing the company's Volksflugzeug alongside two versions of Nr. 280 presented under the heading Einheits-T-L Jäger or 'Standard Jet Fighter'. The Nr. 280 was presented as the best design for both the Volksjäger competition in the short term and the 1-TL-Jäger contest in the long term.

The pamphlet criticises the concept of designing a fighter from scratch around the BMW 003 since "by the time of its first appearance on the front line in large numbers (the last four months of 1945) it is sure to be inferior to enemy jet fighters and only used for a short time because the BMW 003 is too weak".

Instead, it suggests that work should begin immediately on producing the Nr. 280 fuselage. The BMW 003 could be installed within it to begin with and then, when the more powerful HeS 011 became available, it could be fitted into exactly the same airframe with minimal modifications.

It reiterates the claim, made in the Focke-Wulf 1-TL-Jäger blurb, that the Nr. 280 "is a replacement for the Me 262 and offers better flight performance plus significantly lower expenses in fuel, labour and materials".

The BMW 003-equipped Nr. 280 could "be operational in a few months for the sake of power inferiority. If we assume the need to develop a superior single-jet fighter, the total expenses are considerably lower through the creation of a standard jet fighter according to the above proposal".

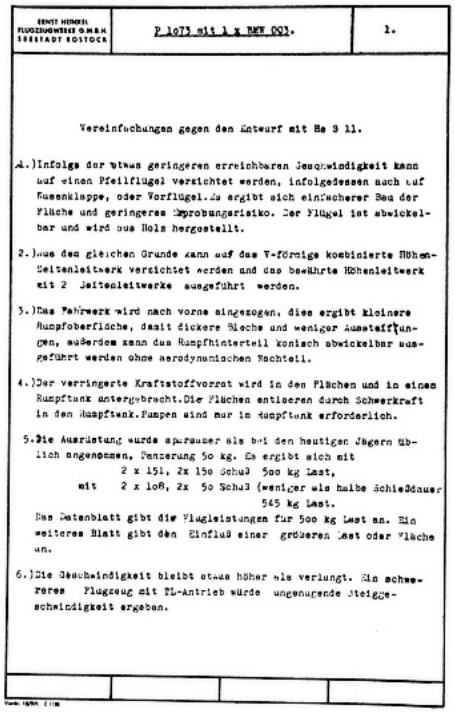
It acknowledges that the original Focke-Wulf Volksjäger entry actually offered better performance figures but states: "The performance difference between the Volksjäger with 003 design and Einheits-T-L Jäger with 003 is irrelevant for temporary use."

JUNKERS VOLKSJÄGER PROJEKT

Almost nothing is known about the Junkers design, except that it was submitted for consideration. It has been suggested that it was given the project number EF 123 or EF 124 but even this is guesswork.

Photographs apparently showing a model of the design have surfaced, however, and from these it appears that the Junkers Volksjäger Projekt had a nose intake with its BMW 003 positioned beneath the forward portion of the fuselage.

The unswept wings were probably to be produced as a single piece and bolted onto the top of the fuselage behind the cockpit. Bulbous fairings on either side of the fuselage just



ERNST HEINKEL FLUGZEUGWERKE G.M.B.H. WARNEMÜNDE/WARNOW

P 1073 mit 1 x BMW 003. 1.

Vereinfachungen gegen den Entwurf mit He S 11.

1.) Infolge der etwas geringeren erreichbaren Geschwindigkeit kann auf einen Pfeilflügel verzichtet werden, infolgedessen auch auf Nasenklappe, oder Vorflügel. Es ergibt sich einfacherer Bau der Fläche und geringeres Erprobungsrisiko. Der Flügel ist abwickelbar und wird aus Holz hergestellt.

2.) Aus den gleichen Grunde kann auf das V-förmige kombinierte Höhen-Seitenleitwerk verzichtet werden und das bewährte Höhenleitwerk mit 2 Seitenleitwerke ausgeführt werden.

3.) Das Fahrwerk wird nach vorne eingezogen, dies ergibt kleinere Rumpfoberfläche, damit dickere Bleche und weniger Aussteffungen, außerdem kann das Rumpfhinterteil konisch abwickelbar ausgeführt werden ohne aerodynamischen Nachteil.

4.) Der verringerte Kraftstoffvorrat wird in den Flächen und in einen Rumpftank untergebracht. Die Flächen entleeren durch Schwerkraft in den Rumpftank. Pumpen sind nur in Rumpftank erforderlich.

5.) Die Ausrüstung wurde sparsamer als bei den heutigen Jägern üblich angenommen. Panzerung 50 kg. Es ergibt sich mit
2 x 151, 2x 150 Schuß 500 kg Last,
mit 2 x 108, 2x 50 Schuß (weniger als halbe Schießdauer
545 kg Last.
Das Datenblatt gibt die Flugleistungen für 500 kg Last an. Ein weiteres Blatt gibt den Einfluß einer größeren Last oder Fläche an.

6.) Die Geschwindigkeit bleibt etwas höher als verlangt. Ein schwereres Flugzeug mit TL-Antrieb würde ungenügende Steiggeschwindigkeit ergeben.

ABOVE: A page from Heinkel's Volksjäger presentation document shows that the P.1073 with BMW 003 was a simplified version of the type designed for the HeS 011 engine. via author

below the cockpit canopy probably housed the aircraft's armament – which was likely to have been a pair of MK 108 cannon.

HEINKEL P.1073 (HE 162)

Like Focke-Wulf, Heinkel seems to have repurposed its entry for the 1-TL-Jäger competition to meet the Volksjäger requirements. The P.1073 – originally designed before July 10, 1944, as a fighter with two Jumo 004C engines, one under the nose and one on its back but now altered to fly with just one HeS 011 – was already close to meeting the Volksjäger specification.

It has also been suggested that Heinkel was told about the upcoming contest two days earlier than everyone else – on September 8, the first day of the 1-TL-Jäger conference. Either way, the company's first design for the Volksjäger, P.1073.01.18, was dated September 11, just one day after the specification was issued.

The accompanying documentation describes the P.1073.01.18 as a 'Kleinst – Jäger' or Midget Fighter and states that it is "a simplification of the design with HeS 011". It bears a remarkable resemblance to what would become the He 162 except the wings are simpler and both nosewheel and main gear retract forwards into the fuselage.

A QUICK COMPETITION

During the September 14 meeting, both the Arado and Junkers designs were rejected outright. Focke-Wulf's proposals did not meet with a positive reaction and Heinkel's design, probably because it was based heavily on the company's already known 1-TL-Jäger project, received a similarly lukewarm reaction.

Heinkel complained that it had been given a different formula with which to work out the P.1073's performance so the following day all the other companies were forced to recalculate their figures based on the same formula.

This only served to demonstrate that the P.1073 was lacking in range and was capable of carrying

only a relatively light weapons load. Heinkel's representatives, however, pointed out that with aircraft such as the He 177 bomber no longer in production, there was now spare capacity available at its capacious and well-equipped factories.

At the same time, concerns arose about the length and position of the P.211's intake duct. It was close to the ground, which would mean any debris lying around on a less-than-perfect airstrip was likely to be sucked into it. Its shape could also induce unwanted drag.

Finally, on September 23, Hitler ordered the P.1073 into mass production as the He 162. In his autobiography The First And The Last, Adolf Galland wrote: "From the beginning I had strongly opposed the Volksjäger project. In contrast to the creators of this idea, my objections were based on factual reasons such as insufficient performance, range, armament, bad conditions of sight, and dubious airworthiness.

"Furthermore I was convinced that this aircraft could not be brought into worthwhile operation before the end of the war. The terrific expenditure of labour and material was bound to be at the expense of the Me 262.

"To my mind all forces ought to be concentrated on this well-tested jet fighter in order to make the best of the possibilities remaining to us. If we scattered our strength once more in this last phase of the war, then all efforts would be in vain."

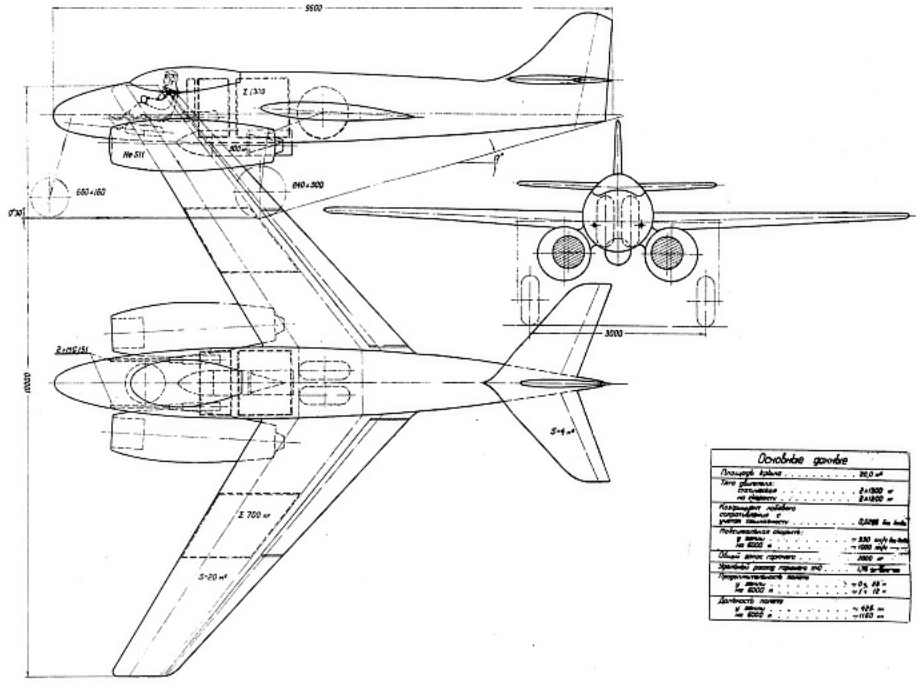
He went on: "My suggestion was to increase mass production of the Me 262 by having it built under licence by all aircraft factories that were not working to capacity, and further to use all these planes only for the air defence of the Reich. This earned me a sharp rebuke from Göring which ran something like this: 'This is unheard of! Now the general of the fighter arm refuses a jet fighter plane which the armament production is offering him by the thousands within a few months.'

"The Volksjäger was to represent a sort of levee en masse in the air. Incredibly schedules were fixed, astronomical production figures were planned. Göring himself became a victim of the national frenzy with which the planning of the Volksjäger had infested almost everyone connected with air defence.

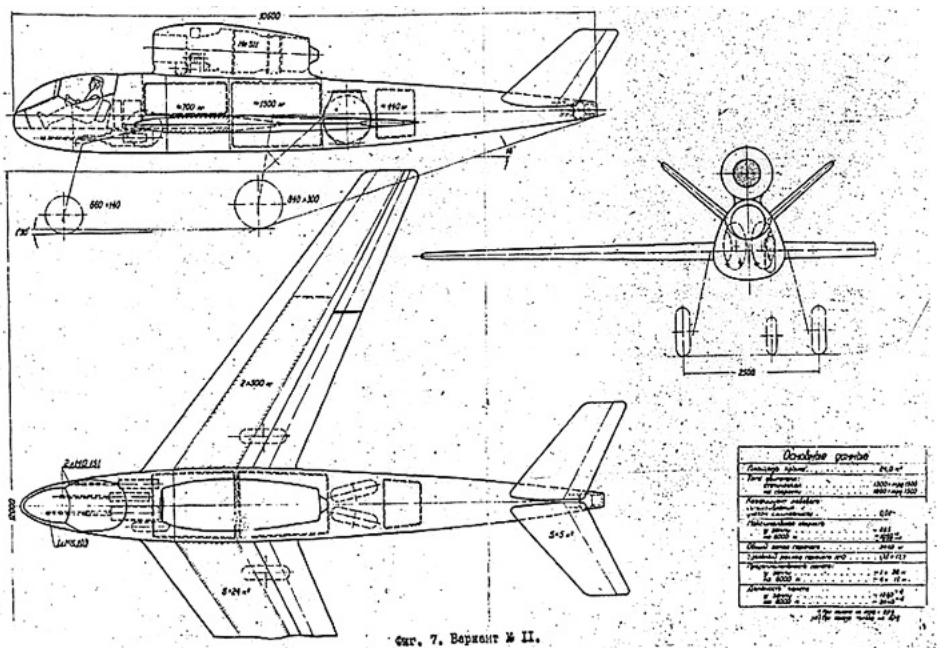
'Hundreds! Thousands! Umpteen thousands!' he cried. 'Until the enemy has been chased back beyond the borders of Germany.'

BUILDING THE VOLKSJÄGER

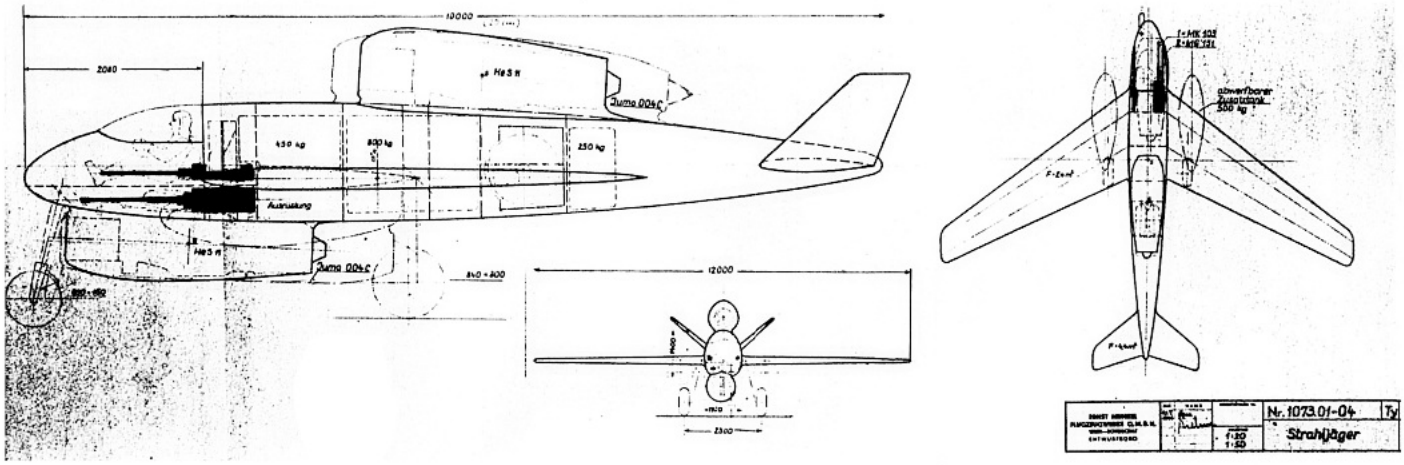
Work on building the first prototypes began on October 25, 1944 – 10 days before the last of the



ABOVE: The radical second P.1073 design featured a pair of turbojets attached to the fuselage beside the cockpit – ahead of and below forward swept wings. It appears here in a Soviet document, presumably redrawn from a Heinkel original captured at Vienna. via Polygon



ABOVE: The single-engined 11th P.1073 design may have been Heinkel's first entry in the 1-TL-Jäger competition. Another Soviet redrawing. via Polygon



ABOVE: The fourth of Heinkel's P.1073 designs, dating from July 10, 1944. The layout is clearly not finalised, with options for fitting either the HeS 011 or Jumo 004 both above and below the fuselage. via author

detailed construction drawings had even been completed. The He 162 was to be tested with both 30mm MK 108 and MG 151/20 cannon, projected as the A-1 and A-2 versions respectively.

It was also to be fitted with a BMW 003 jet engine, an undercarriage derived from that of the Bf 109 to cut production time and cost, and a Heinkel device first seen on the He 280 prototypes and test rigs – the world's first operational military ejection seat.

The He 162 M1 (V1) was finished and ready to fly on December 1, 1944. Its maiden flight came on December 6. Four days later, during another test, it was destroyed when instability combined with poor glue bonding led to the leading edge of the starboard wing coming off mid-flight. Test pilot Gotthold Peter was killed.

The second prototype, He 162 M2 WNr. 200002, first flew on December 22. Another eight prototype and pre-production machines followed in quick success and were soon being used to test everything from landing gear and armament to vibration and directional snaking. Meanwhile, Heinkel's factories were gearing up for full production – a quota of 30 He 162A-1s was expected by the end of January 1945.

There were five facilities involved: EHAG (Ernst Heinkel AG) Nord Rostock-Marienehe, EHAG Süd Wien-Schwechat, Junkers' Bernburg factory and the underground facilities at Hinterbrühl, codenamed 'Languste', and Mittelwerk Nordhausen.

All of them employed slave labourers – some 22,500 in total, including 8000 at Rostock alone, accounting for 55% of the workforce.

During an inspection of the production lines on January 27 it was determined that so far, two production machines had been flown, 12 had had engine tests completed, 58 fuselages were complete and another 71 were nearing completion.

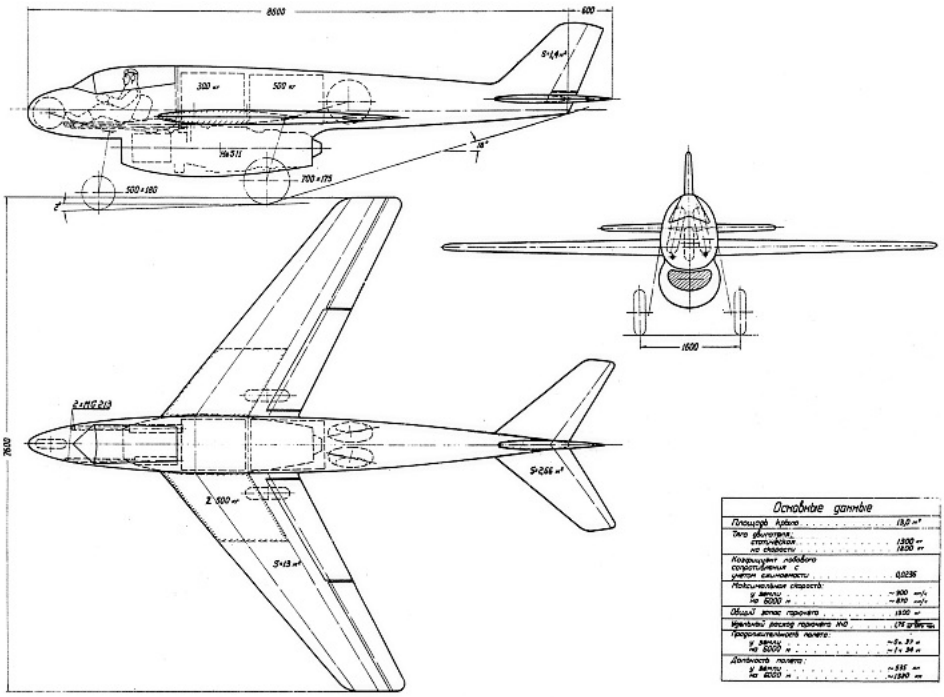
A second test pilot was killed on February 4, 1945. Oberleutnant Georg Weydemeyer crashed the sixth prototype during its 11th test flight. It was found later that there appeared to have been insufficient glue used on the plywood skin covering the ribs of the tail unit.

The first five production machines were ready to go by February 9 – work at Heinkel's factories having been slowed by blackouts resulting from the damage caused to Germany's electrical power infrastructure during heavy bombing.

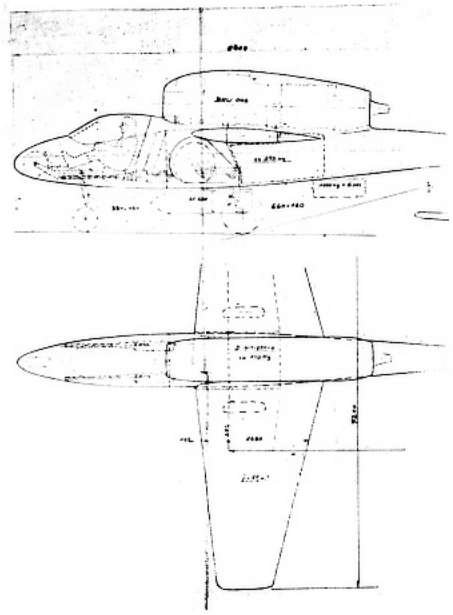
It was decided in January that rather than form a new Luftwaffe unit to operate the He 162, an established unit should be converted to it, and JG 1 was chosen. I./JG 1 was pulled back from the front line on February 6 for this purpose and its 23 surviving Fw 190A-8s and A-9s given to II./JG 1 to replace losses it had suffered.

The Gruppe, now minus its aircraft, transferred to Parchim, 50 miles south of Rostock, on February 9. No He 162s were immediately available, so I./JG 1's pilots and crew began familiarisation training with EHAG personnel on February 12.

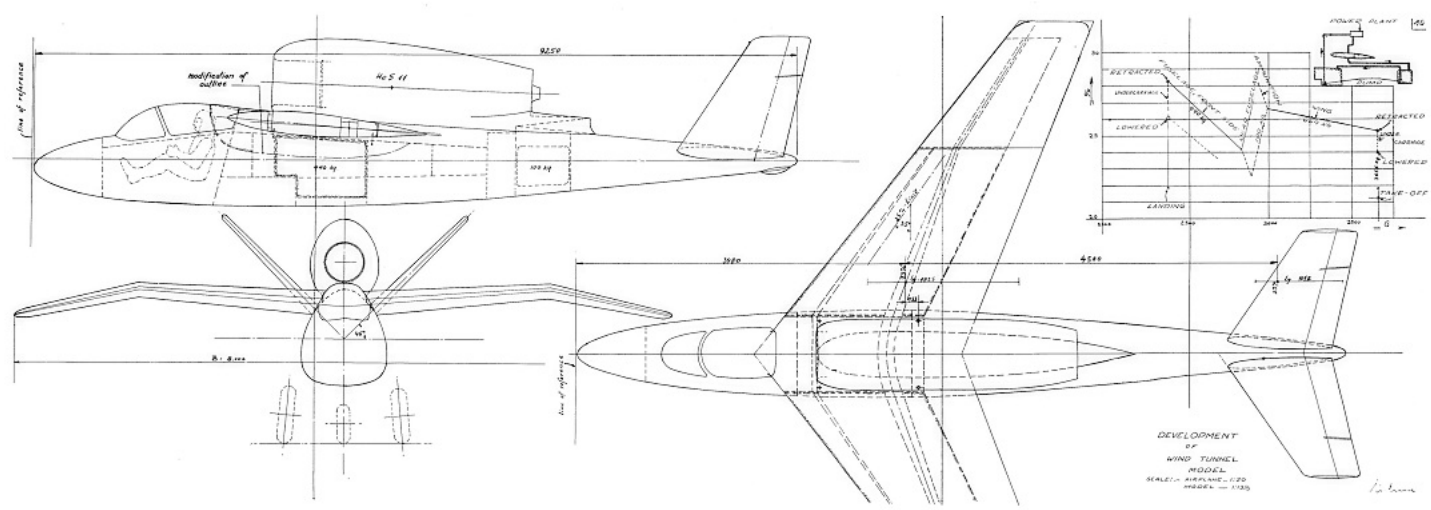
An Auffangsstaffel or 'collection squadron' from 2./JG 1 was sent to Heidfeld – the airfield at Heinkel's Rostock headquarters – on February 27 to pick up a single aircraft



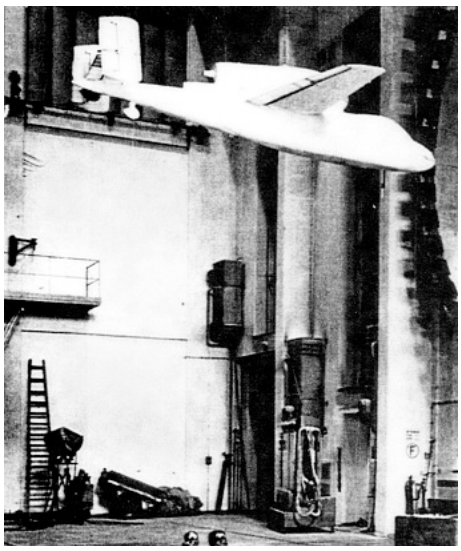
ABOVE: Another potential candidate as Heinkel's initial 1-TL-Jäger design is the 13th P.1073 – this time with its lone HeS 011 engine positioned beneath the fuselage. Yet another Soviet redraft. via Polygon



ABOVE: Its undercarriage arrangement differed significantly from that of the finished product, but this P.1073 design from October 1944 was the last before it was given the RLM designation 8-162 – the He 162. via author



ABOVE: Plans for a wind tunnel model of a He 162 with V-tail and swept wings with Allied annotations in English. Rather than being an advanced development of the type, this appears to be version 19 from September 23, 1944. GDC



ABOVE: A large wind tunnel model of the He 162 being tested in early 1945 at Berlin-Adlershof.

ABOVE: The Junkers manufacturing facility in a former salt mine at Tarthun, near Egeln, was set up to turn out thousands of Heinkel He 162s but frequent power cuts and the difficulty of supplying it with parts severely hampered production. via author

brought over from Junkers at Bernburg. This was He 162 M19 WNr. 220002.

A second group of pilots, from I./JG 1, arrived at Rostock on March 4 to collect more aircraft but none were available so they were told they too would have to make do with M19.

A third pilot was killed in a He 162 on March 14, when Unteroffizier Tautz of 2./JG 1 hit a stack of barrels while attempting to land M19. The aircraft span into the ground and Tautz, thrown clear of the cockpit, suffered fatal injuries.

Now there were no He 162s available for conversion training. On March 26, it was announced that JG 1 would relocate in readiness to receive completed aircraft leaving the Junkers production line. A group of 15 pilots from 3./JG 1 moved to Lechfeld but there was still nothing available to fly.

On the 27th, Hermann Steckham attempted to take off on a test flight at Bernburg in production He 162 WNr. 310001 but suffered engine failure which resulted in the aircraft coming down hard. It was a total write-off and Steckham was badly injured.

I./JG 1 was told on March 31 that it would have to move to Leck at the northernmost extreme of Germany. On the same day, with JG 1 personnel now scattered across Germany, He 162 deliveries finally began.

Simultaneously, as the enemy advanced from east and west, evacuation of He 162 production facilities was begun. EHAG Süd at Wien began shutting down on April 1.

He 162 'White 1' was flown by 2./JG 1's Leutnant Rudolf Schmitt for 20 minutes at Parchim on April 3. Having joined the Luftwaffe as an 18-year-old in August 1943, he initially trained at Luftkriegschule 2 in Berlin before moving to Flugzeugführerschule C6 in Kolberg. In May 1944 he was transferred to 2./JG 107, which was stationed in Hungary, and then 5. and 6./JG 108, based at Wiener-Neustadt. Finally, on February 16, 1945, he joined 1./JG 1, switching to 2./JG 2 shortly thereafter.

Unteroffizier Helmut Rechenbach of 2./JG 1 crashed and was killed while ferrying a He 162 from the factory on April 6, bringing the aircraft's death toll to four.

By April 12, 1945, I./JG 1 had 16 He 162s at Parchim, of which 10-12 were serviceable. Two days later, one of the unit's most experienced pilots, Feldwebel Friedrich Enderle, was killed when his He 162 came down shortly after take-off at Ludwigslust and exploded.

The following day, April 15, I./JG 1 began its delayed move to Leck. Flying He 162 'White 7' from Ludwigslust to Husum, a fuel stop along the way, Leutnant Schmitt encountered a Spitfire at 3.40pm but used his aircraft's speed to avoid an engagement, as he had been ordered.

On April 17, Unteroffizier Josef Rieder had a problem with his He 162's flaps on take-off and crashed, suffering serious spinal injuries but the following day Unteroffizier Wolfgang Hartung of 2./JG 1 came down during another transfer flight and was killed in the crash – the sixth He 162 fatality.

The He 162 was approaching true front line service when the war ended. Heinkel's Rostock production facility was overrun on or shortly after May 1.

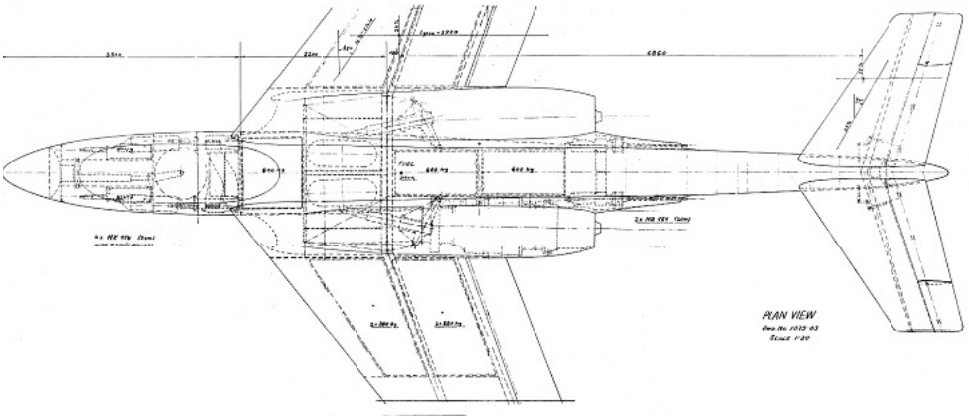
It is believed that, in the end, some 171 He 162s were built, with 116 actually being delivered. The Luftwaffe received 56 of these before production finally collapsed at the end of April. At least nine men had been killed in flying accident involving the He 162 – whether due to a failed airframe, a failed engine, inherent design flaws or simply the sheer trickiness of piloting the delicate little aircraft. ●

BELOW: The sixth He 162 prototype, M6, rolls down the runway at the beginning of a test flight in early 1945. via author

State of the art

Schlechtwetter und Nachtjäger (January 1945)

Towards the end of January 1945, a fresh requirement was issued for a definitive jet-powered night fighter. The resulting competition produced the largest, heaviest and most striking jet fighter designs yet committed to paper – the apex of jet fighter design in Germany during the Second World War.



ABOVE: A detailed drawing of Heinkel's P.1079 night fighter produced for the Americans, or perhaps simply copied for them from an earlier original drawing. via Scott Lowther

The bad weather and night fighter competition launched during the summer of 1944 had resulted in a series of stopgap designs where existing types were heavily modified to perform this additional role.

The most promising of these was Messerschmitt's Me 262B-2a with Arado's Ar 234P-5 being the most likely runner-up.

However, neither of these was ever likely to have the range to fulfil the traditional night fighter role already being carried out by piston-engine aircraft such as the Ju 88Cs and Gs.

Similarly, neither aircraft had the fuselage capacity to accommodate all the electronic equipment and weaponry by this point necessary to successfully wage war in the air at night.

The apparently imminent arrival of the powerful HeS 011 also put the two Jumo 004-powered types at a disadvantage. It would take too long to redesign them to make best use of an engine producing 2700lb-ft of thrust compared to their existing powerplants' 1980lb-ft.

As a result, six companies were invited to tender for a new heavy fighter requirement – Arado, Blohm & Voss, Dornier, Focke-Wulf, Gothaer and Heinkel. The requirement issued on January 27, 1945, called for a two-seater machine that could reach 900kph (559mph) at 9000m (29,500ft) and maintain full throttle for four hours.

A meeting was held on February 26, 1945, to review the initial designs and the following day a new set of specifications was issued which emphasised heavier armament, the ability to carry more equipment and the inclusion of a third crewman to manage all the additional kit.

The designs that resulted from this were extremely well armed, could fly for acceptably long distances and were packed with the most advanced electronic systems then available.

Arado came up with two designs known simply as Arado I and Arado II, although it has been suggested that these were both referred to internally as different iterations of project E.583. Blohm & Voss produced a grossly enlarged and enhanced version of its P.212 bat-wing fighter design, the P.215, Dornier tinkered with its Do 335 to come up with the P.256, and Focke-Wulf used a twin-engine single-seat fighter design – produced in November 1944 – to come up with four similar versions of the same thing and chose the second and third of these to compete.

The usual company naming system came into play, simplifying the internal Focke-Wulf designations to just Focke-Wulf II and Focke-Wulf III. Gothaer offered a flying wing called the P-60C and Heinkel designed the P.1079 – perhaps the most advanced design of them all – though it was not ready in time to compete with the others.

The private reaction of the various companies to this requirement is unknown except for that of Focke-Wulf, which produced an unattributed internal document dated March 22, 1945, expressing its deep unhappiness. The firm regarded it as a mistake to require jet fighters designed for long range operations to also carry such a heavy payload of weaponry.

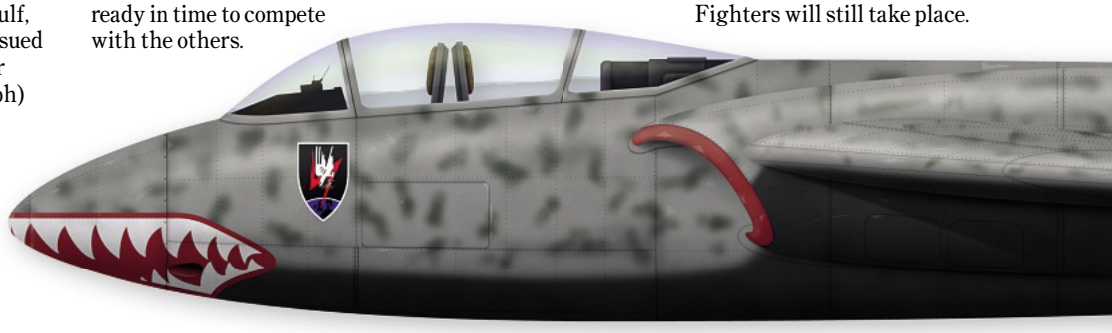
It stated: "In the response to the invitation to tender of February 27, 1945, drawn up by the head of the Technischen Luftrüstung, none of the demands are met in their entirety by any of the designs.

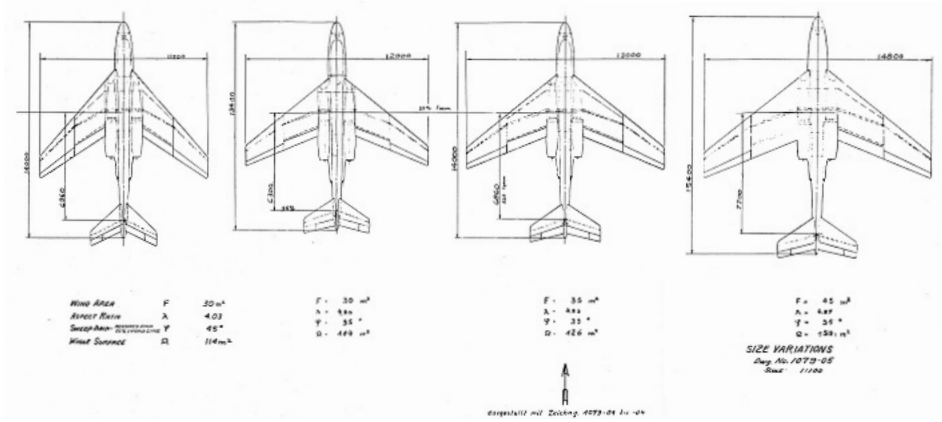
"Any attempt to meet the large required flight duration with two jet engines led, due to excessive departure weights, to insufficient power on starting. Designs with three turbojets, that are not considered further here, give a weight of approx. 19 tons and require not only a greater expense in work hours to build, but also yield a fighter that is too unwieldy for use as a night-time and bad weather aircraft.

"Operational experience with the Ju 88 has already shown that such a large aircraft has insufficient manoeuvrability. It would be better, therefore, to limit the load in relation to the tender and allow the aircraft to be kept as small as possible.

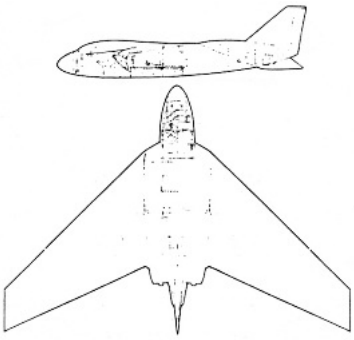
"Studies on possible use and flight duration show that a fuel quantity of about 4000kg for the two-engined jet-night fighter with HeS 011 will be adequate. This results in a wing surface area of about 45sq m to 55sq m and a flying weight of 11.5 to 13 tons.

"If you add the demand for defensive armament, the flight weight increases by about 750kg more and the wing area by about 3sq m. Thereby, the performance and handling characteristics are correspondingly poorer, so especially in view of the bad weather fighter where speed is of particular importance, a re-examination of this demand seems necessary. A final statement by the Inspector of Night Fighters will still take place.

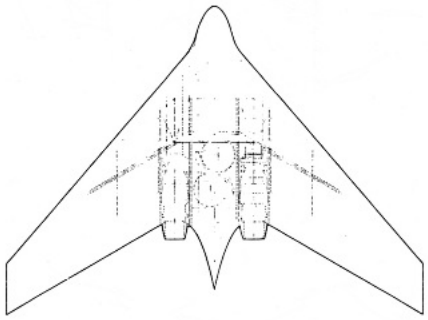




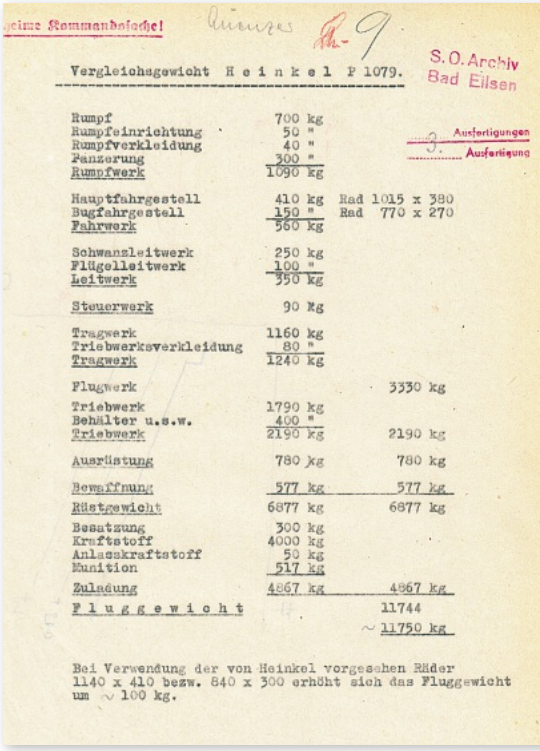
ABOVE: It was envisioned that the P.1079 could be scaled up or down and the sweep of its wing made more or less pronounced. via Scott Lowther



ABOVE: The 'first' tailless P.1079B as reproduced in poor quality within the German Aircraft: New and Projected Types report. TNA



ABOVE: With a shortened nose and minimal tail, the P.1079B came close to being a flying wing. TNA



Geheime Kommandosache!

Vergleichsgewicht Heinkel P 1079.

S.O. Archiv Bad Eilsen

3 Ausfertigungen
1 Ausfertigung

Rumpf	700 kg		
Rumpfeinrichtung	50 "		
Rumpfverkleidung	40 "		
Panzerung	300 "		
Rumpfwerk	1090 kg		
Hauptfahrgestell	410 kg	Rad 1015 x 380	
Bugfahrgestell	150 "	Rad 770 x 270	
Fahrwerk	560 kg		
Schwanzleitwerk	250 kg		
Flügelleitwerk	100 "		
Leitwerk	350 kg		
Steuerwerk	90 kg		
Tragwerk	1160 kg		
Triebwerksverkleidung	80 "		
Tragwerk	1240 kg		
Flugwerk			3330 kg
Triebwerk	1790 kg		
Behälter u.s.w.	400 "		
Triebwerk	2190 kg		2190 kg
Ausrüstung	780 kg		780 kg
Bewaffnung	577 kg		577 kg
Rüstgewicht	6877 kg		6877 kg
Besatzung	300 kg		
Kraftstoff	4000 kg		
Anlasskraftstoff	50 kg		
Munition	517 kg		
Zuladung	4867 kg		4867 kg
Fluggewicht			11744
			~ 11750 kg

Bei Verwendung der von Heinkel vorgesehen Räder 1140 x 410 bezw. 840 x 300 erhöht sich das Fluggewicht um ~ 100 kg.

ABOVE: Clear evidence from Focke-Wulf's wartime files that the P.1079 was not invented solely for the benefit of the Americans who 'employed' Heinkel's design team immediately after the war's end. A data sheet showing the weight of the type's various components. GDC

"Most of the participating aircraft companies were anxious to meet the requirements of the tender with regard to flight time as much as possible. For this reason, projects submitted were bulky and offered unsatisfactory performance. An improvement in performance can only be achieved by reducing the payload."

The report goes on to say it accepts that small improvements in flight performance will be made through "repeated editing" of designs and that the absolute size of the aircraft would no doubt be reduced a little as a result.

It has been suggested by one writer that a decision was made on the competitors at a meeting at Focke-Wulf's Bad Eilsen design headquarters on March 20-21 but this document seems to suggest otherwise. If the suggested outcome is to be believed, Focke-Wulf's own designs were rejected along with that of Dornier, leaving Arado, Blohm & Voss and Gotha as the 'finalists'.

HEINKEL P.1079

With regard to the Heinkel P.1079, the same writer states: "Despite an intensive search, no evidence has come to light in any surviving German archives that the company, already overburdened with a multitude of development projects, ever submitted a design for a night and all-weather fighter to the commission in Berlin.

"It is possible that the projects department in Vienna did produce drawings and data sheets for such an aircraft under the designation P.1079, but no original documents for the period up to April 1945 have been found."

Such a document does exist in a British archive however, and was part of the Focke-Wulf report detailed earlier. What is not clear, however, is whether the Heinkel P.1079 was ever seriously considered as part of the last Schlechtwetter und Nachtjäger competition before the war ended.

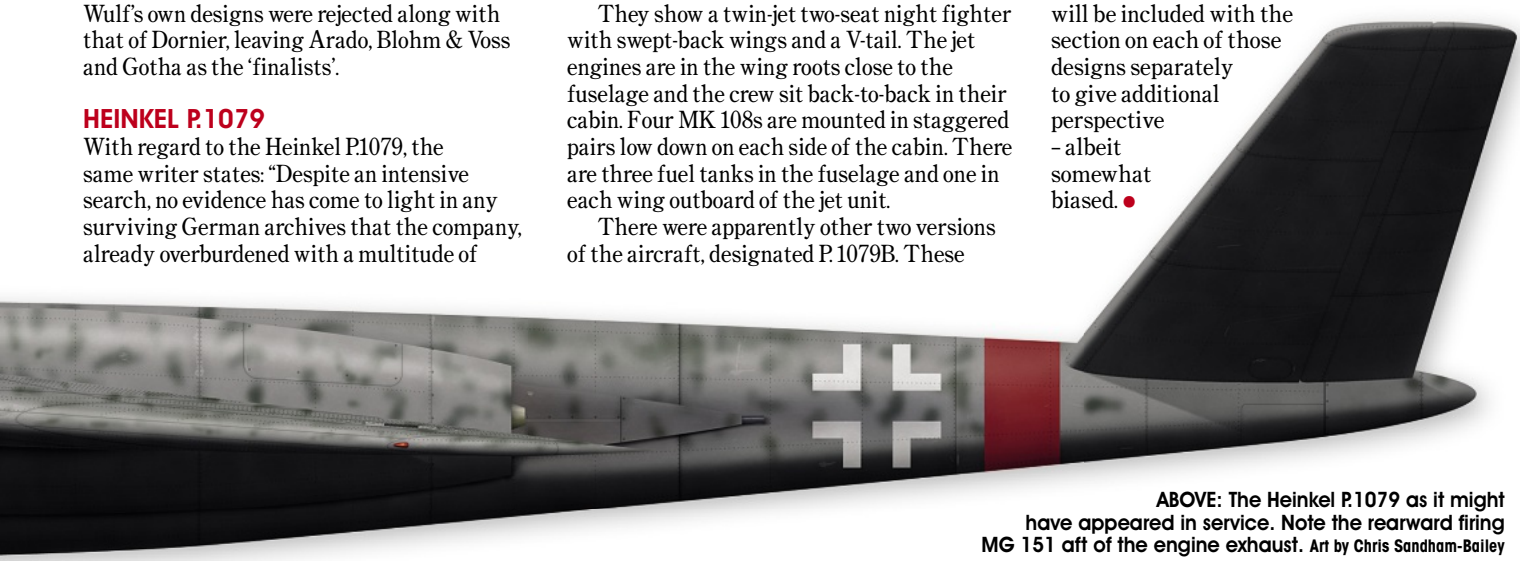
The drawings featured here, though roughly contemporary, may well have resulted from re-drawings made after the war's end by Heinkel's design department under American supervision.

They show a twin-jet two-seat night fighter with swept-back wings and a V-tail. The jet engines are in the wing roots close to the fuselage and the crew sit back-to-back in their cabin. Four MK 108s are mounted in staggered pairs low down on each side of the cabin. There are three fuel tanks in the fuselage and one in each wing outboard of the jet unit.

There were apparently other two versions of the aircraft, designated P.1079B. These were both tailless designs. One followed fairly closely on the lines of the P.1079 aircraft already described but the rear portion of the fuselage and V-tail were replaced by a single fin and rudder. The nose was also shortened and modified to provide staggered seating.

The other version of the P.1079B was closer to being a flying wing design. The vertical fin was eliminated and there were gull wings with pronounced anhedral on the outer panels. The jet units were more widely spaced and the main wheels were stowed flat between them, one retracting upwards and forwards and the other upwards and rearwards.

In addition to its general criticism of the requirement itself, the Focke-Wulf document also offers comments made on March 25, 1945, by the company's Arbeitsgruppe Flugmechanik H Wolff, criticising each design individually. These will be included with the section on each of those designs separately to give additional perspective – albeit somewhat biased. ●



ABOVE: The Heinkel P.1079 as it might have appeared in service. Note the rearward firing MG 151 aft of the engine exhaust. Art by Chris Sandham-Bailey

I and II

Schlechtwetter und Nachtjäger – Arado

Having received a largely negative reaction to its proposed Volksjäger design, Arado was determined to offer a genuine contender for the night and bad weather fighter competition and it did so with not one but two advanced designs – simply known as Arado I and II.

ARADO I

With a great deal of practical experience with jet-engined aircraft now in hand, Arado felt it was in a strong position going into the contest.

Its first design was its most unusual – a tailless low-wing aircraft with broad swept-back wings. It was not a flying wing, however, since it had a long central fuselage which housed its radar, nosewheel, forward-firing armament, pressurised cockpit for three crew members, two self-sealing fuel tanks, a drag chute to the rear, upwards firing armament and rearwards firing armament too.

There were three smallish fuel tanks in each wings and the two HeS 011 turbojets were built into the bottom of the rear fuselage and had a combined, broad, flat intake.

A little way in from each wing tip was a vertical fin and rudder. The ailerons were to act as elevators and split flaps were to be fitted on the inner section of each mainplane. The undercarriage main wheels retracted almost vertically up into the wing roots thanks to a clever strut arrangement.

Data sheets presented for the competition by Arado give the aircraft's weaponry as "Final Solution: rigid forward: 2 x MK 213/30 with 200 rounds each. Schrag [oblique] armament: 2 x MK 108 with 100 rounds. Defensive [rearward firing] armament: 2 x MK 213 with 200 rounds."

The accompanying drawing clearly shows six MK 108 cannon clustered together in the nose yet two 30mm MK 213 cannon may well have offered the same degree of destructive power. This was because they were revolvers intended to have a rate of fire that was three times that of the MK 108. A conversion kit was also offered which would allow the Arado I type to carry a pair of SC500 bombs.

The cabin had two crew members seated side by side facing forwards and the third directly behind them facing towards the rear of the aircraft. Each had an ejection seat.

Radio and other electronic equipment is given as: "FuG 24, FuG 29, FuG 25a, Fu Bl 3, FuG 101, Peil G 6 and APZ 6, FuG 244, FuG 280."

It has been suggested that the Arado I night fighter was based on research conducted during Arado's E.581 fighter project, detailed briefly elsewhere in this publication, or the company's E.555 flying wing bomber studies.

There is some faint resemblance to both, and also to the TEW 16/43 designs – the engine position, the twin fins and the bubble canopy were all features of earlier designs. Even the swept wing shape is not dissimilar to designs already seen elsewhere in Arado's portfolio.

However, unlike Focke-Wulf, Blohm & Voss and others, there are large gaps in our knowledge of Arado's technical design office and its drawings. It seems more likely that the strand of development which led more directly to the Arado I either has yet to be discovered or may now be lost.

ARADO II

The company fell back on a more familiar shape for its second night fighter design. The Arado II was a shoulder-wing type with swept-back wing and tailplane and a broad fin.

The two-piece wings, which housed part of the fuel supply, were of composite construction and carried the aircraft's two HeS 011 turbo-jets. These were in underslung nacelles which did not project beyond the edges of the wings themselves.

The fuselage was rounded and contained a pressurised cabin for a crew of three, additional fuel tankage, all three wheels of the retractable tricycle undercarriage, armament, radio and radar. A parachute brake was fitted in the rear fuselage and ejection seats were provided for the three crew members – two seated side by side at the front and the third positioned sideways on directly behind them.

Armament, radio and radar were the same as for the Arado I except that three 500kg bombs could be carried with the optional conversion kit. According to German Aircraft: New and Projected Types: "A variant of this project incorporated a V-tail." Yet another version seems to have had a more substantial tail turret to house its two rearward firing MK 213 revolver cannon.

ASSESSMENT

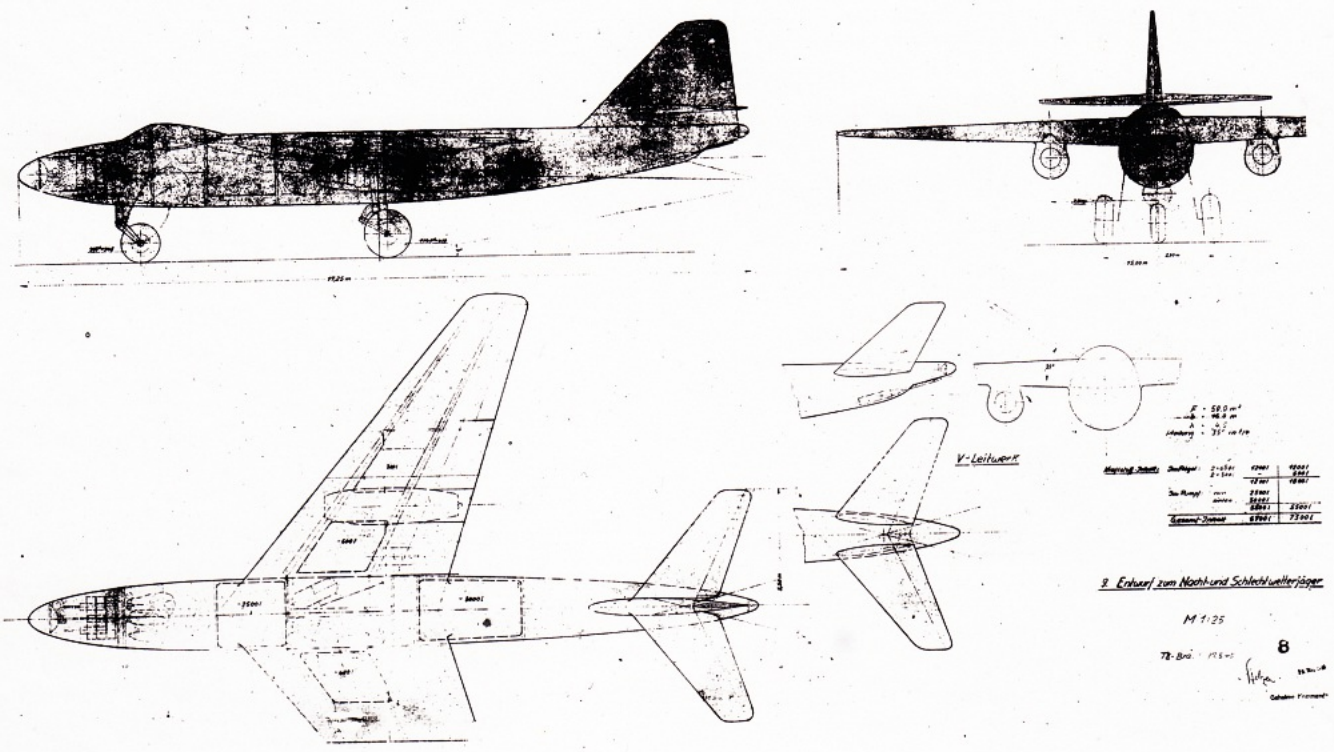
Focke-Wulf's mechanic H Wolff had nothing but criticism for Arado's designs. Where Arado I was concerned he wrote: "Critical point is the bad engine inlet, which should cause a loss of thrust of at least 4% with a long run-up track and flattened aperture. Because of the large wing depth, a strong Mach effect will exist at the centre fuselage. The cab structure is kept strikingly wide and the total surface area is relatively large."

For Arado II he noted: "Despite the smaller wing area, the overall surface area is as large as that of Arado I. The high interference and resistance of the engine nacelles should also be noted."

Concerning both, he wrote: "The low speed level of the Arado projects results essentially from the large surfaces and the bad engine internals."

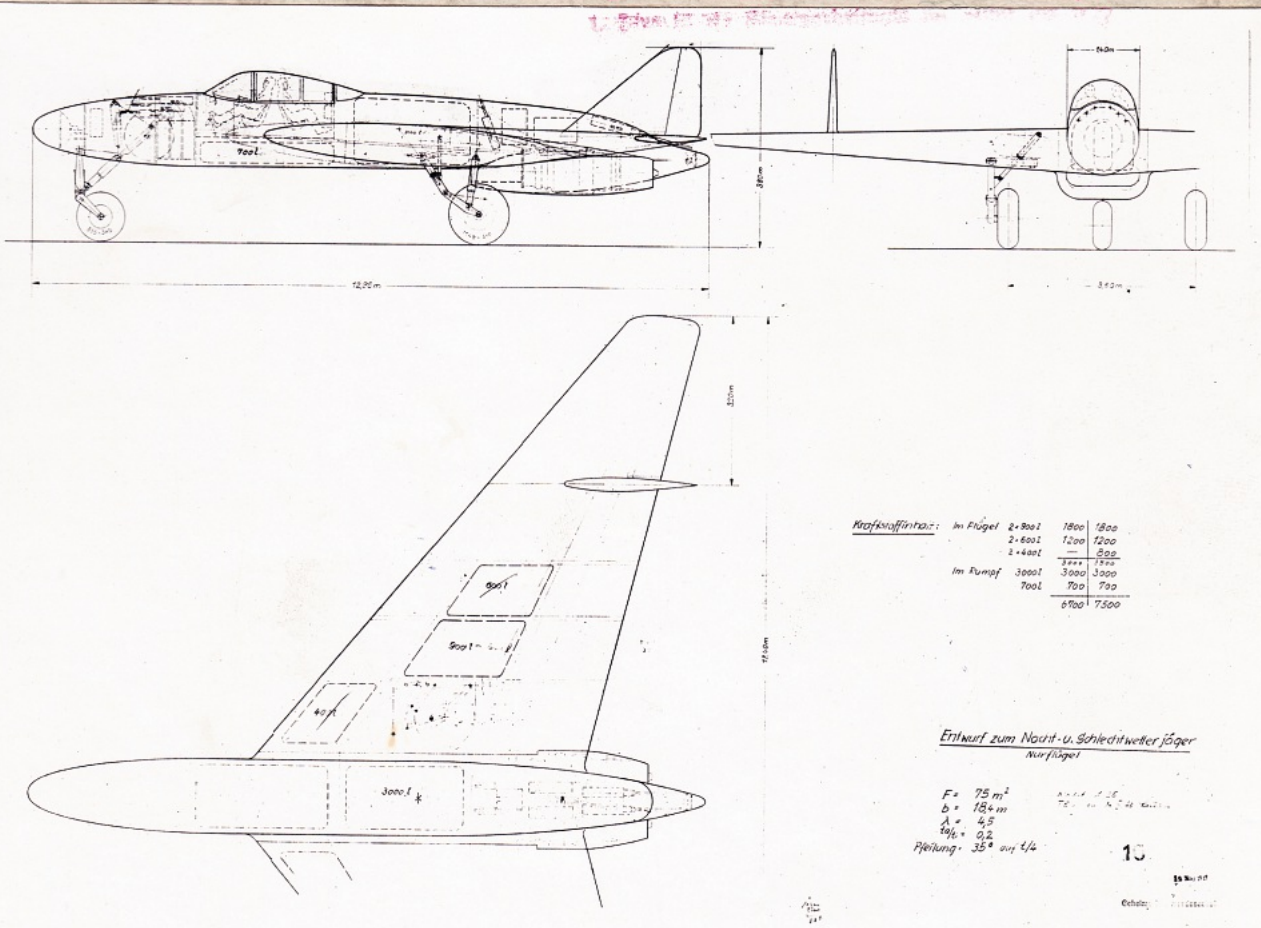
He also expressed concern about the endurance of the Arado designs, which was particularly poor with the Arado II with a total flight time of just two hours and 12 minutes compared to between two hours, 48 minutes and three hours for the other competitors. ●

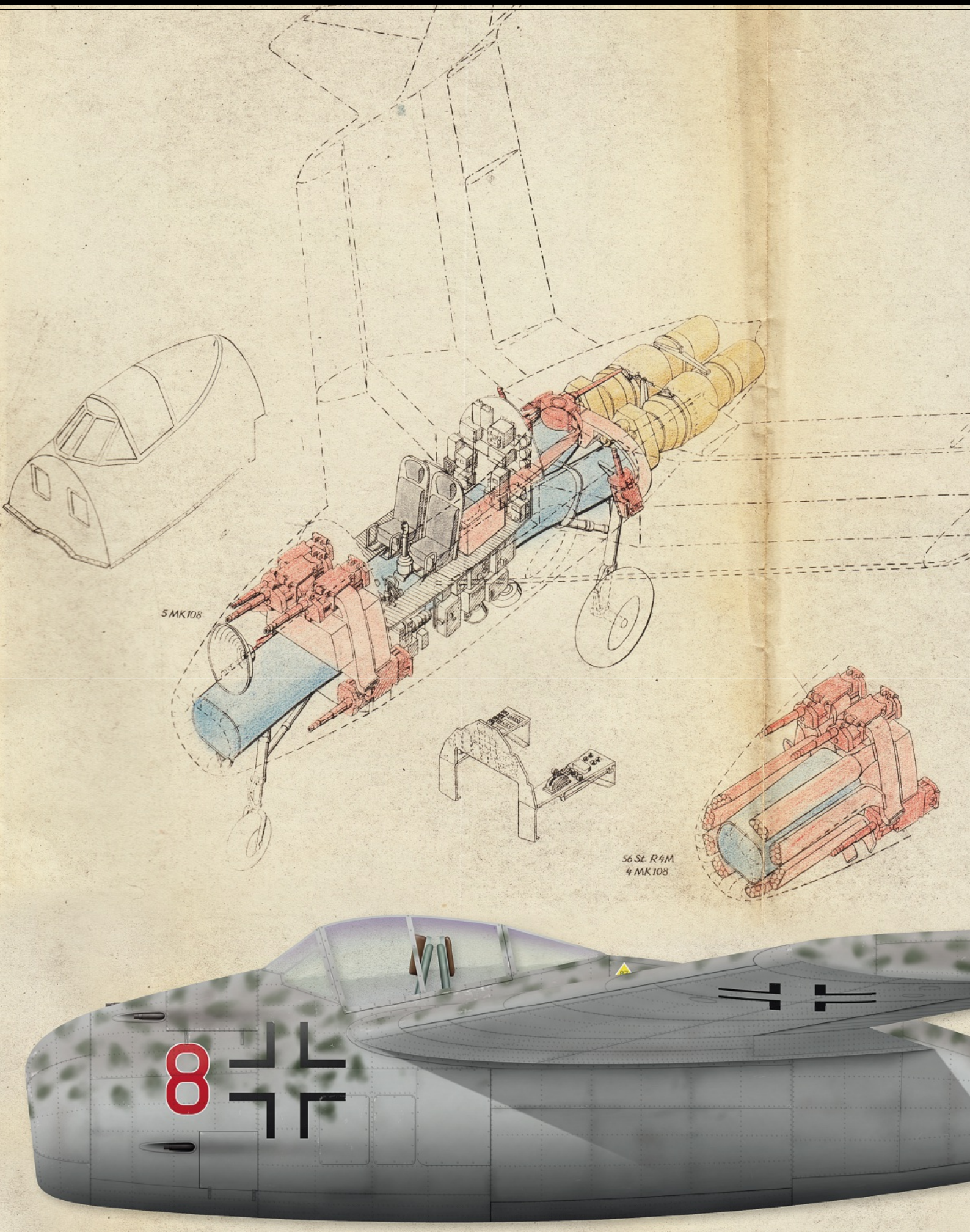
ABOVE: The Arado I design as it may have looked as a pure interceptor, with a reduced forward armament of four MK 108 cannon and with both oblique and rearward-firing armament removed to reduce weight and improve performance. Art by Chris Sandham-Bailey



The two Arado night fighter designs as seen on a contemporary German report from March 1945 – Arado II above and Arado I below. These are actually photographs of reproductions of the drawings that were glued into the report by hand. GDC

Geheime Kommandosache!




5 MK 108
56 St. R 4M
4 MK 108

P.215

Schlechtwetter und Nachtjäger – Blohm & Voss

When it was asked to submit designs for a large night fighter, Blohm & Voss's drawing office was heavily invested in its P.212 single-jet fighter design. It was logical, therefore, that this should simply be enlarged to meet the new competition's requirements. Doing so created a monster.

One of the best known and perhaps most fearsome German 'secret projects' designs of the Second World War is Blohm & Voss's P.215.

It is not the tailless shape, the bat wings or the gaping nose intake that tend to inspire dread, however, but the range of weapons options with which the company presented it.

At a time when air-to-air missiles were still in their infancy, and since the P.215's primary mission would be to take down bombers at night, it could have potentially been endowed with a level of raw straight-ahead unguided firepower like no other.

According to the introduction to the P.215 brochure, dated March 1945: "The 215 project grew out of the P 212 design, a day fighter with only one turbojet.

"With a three-man crew, with reinforced armament, with increased flight time and with two turbojets the dimensions of the aircraft are correspondingly large. However, the entire arrangement is largely similar to that of the day-fighters.

"The two turbojets are built into the rear fuselage and get fed from a front fuselage nose intake via a common channel. The armament is gathered in a weapons section, which is directly behind the antenna devices and in front of the crew cabin.

"Nose and main landing gear are both hinged to the fuselage. The aircraft is therefore transportable after removing the wings. This brings advantages in the final assembly, because the transport scaffolding can be omitted.

"The hull itself is easy to assemble because the principal components are reattached to the TL-inlet pipe. The swept wing is particularly characterized by its tail edge."

Regarding the wings, the brochure states: "In order to get not too large aircraft dimensions, the wing size of 50 square metres was left unchanged (without border control surfaces)."

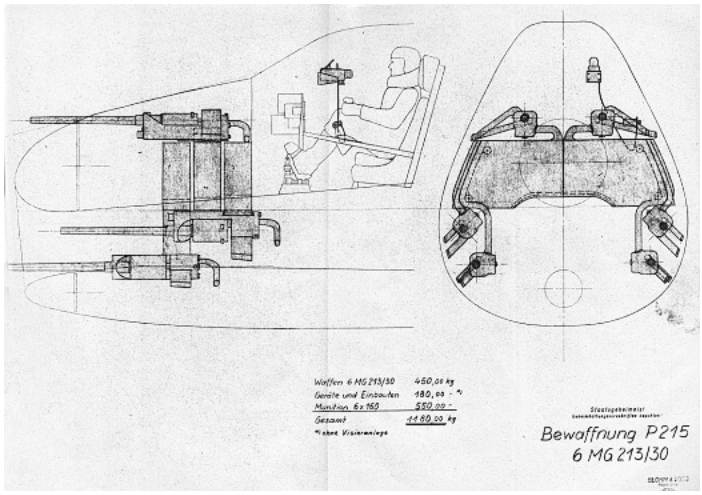
The aspect ratio had been increased, however, to provide more fuel-efficient flight at an altitude of 32,800ft. The brochure continues: "If no consideration is given to this, the required fuel weight increases significantly. The wing component is divided into a body portion and the left and right wings, each with a flange separation point on the hull.

"The fuselage wing piece is mounted on the fuselage pylon, with a pair of main terminals on the rear spar and one each right and left. The actual support system is a broad wing box, made of welded steel plate. All these boxes can also be used as fuel tanks.

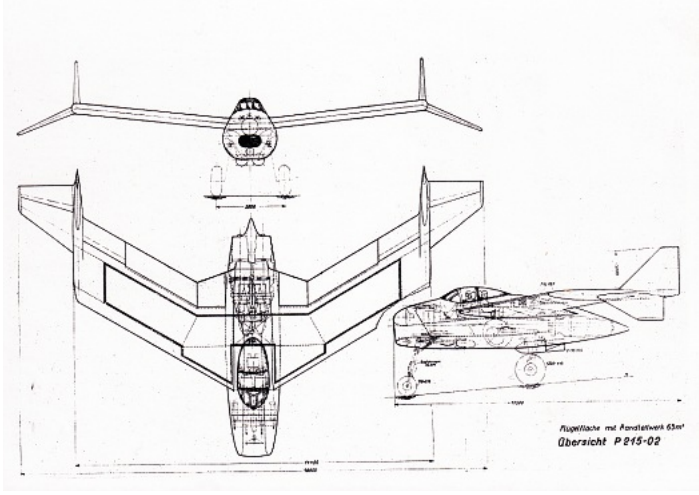
"The wing leading edge, made of either duraluminium or steel is firmly attached to ▶

OPPOSITE PAGE: Coloured artwork from the original Blohm & Voss P.215 night fighter project brochure. Pictured towards the bottom centre of the drawing is the type's fearsome alternative armament of 56 R4M rockets and four MK 108 cannon in red around the blue jet intake tube. GDC

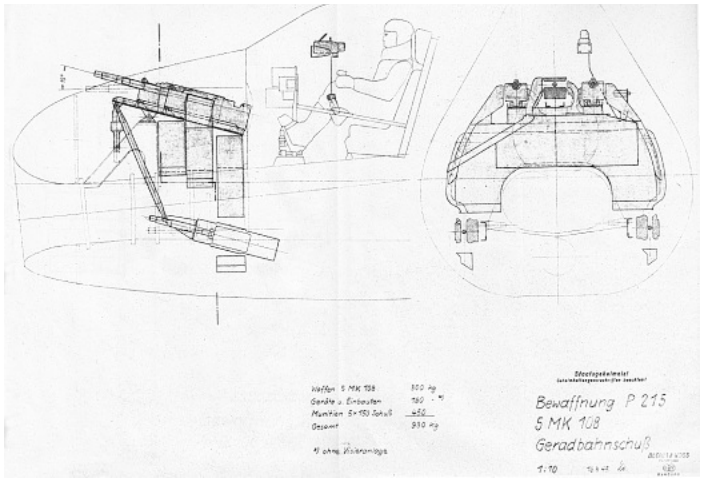
LEFT: The P.215 as seen with normal 'attack' armament of five MK 108 30mm cannon. The two swivel-mounted rear facing MK 108s are obscured by the wing. Art by Chris Sandham-Bailey



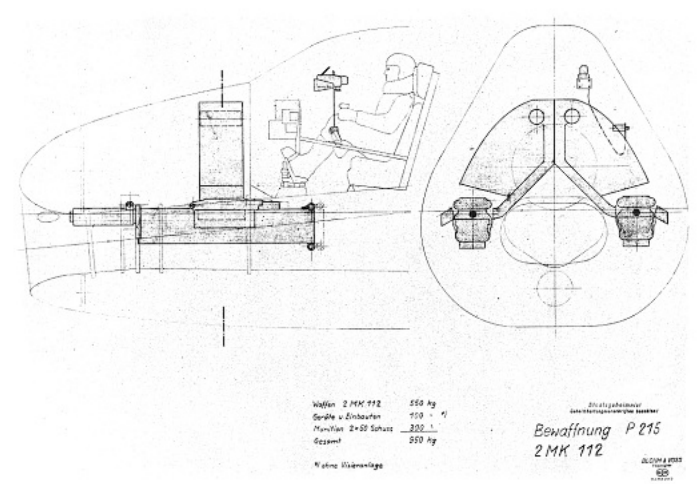
ABOVE: A straightforward armament of six MG 213/30 cannon would have seen the P.215's nose crammed with large ammunition containers. The MG 213 had a spectacular rate of fire and high muzzle velocity which would have made it much more effective than the MK 108. GDC



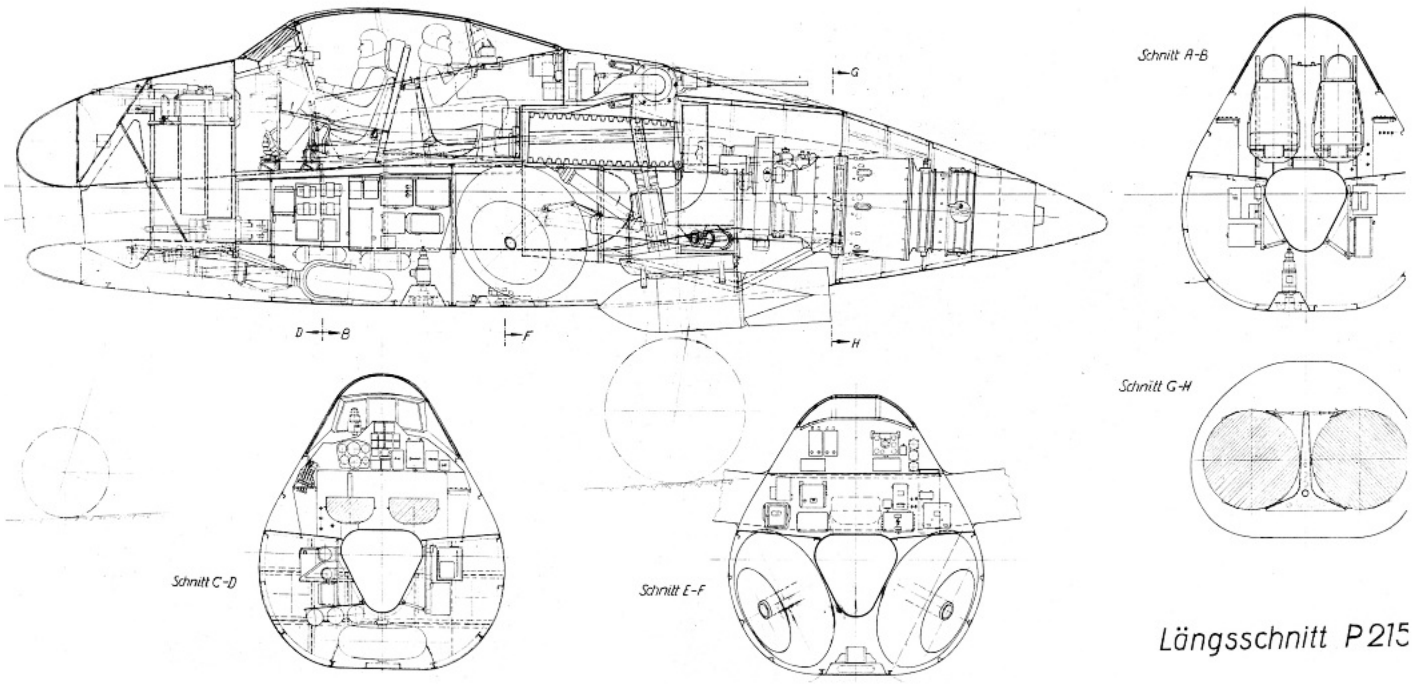
ABOVE: Three-view drawing of the P.215-02 from a contemporary German report. The -02 side view shows a redesigned cockpit canopy from that shown in the detailed side view of the project brochure, which was presumably the -01. The coloured brochure image, however, shows the -02 canopy. GDC



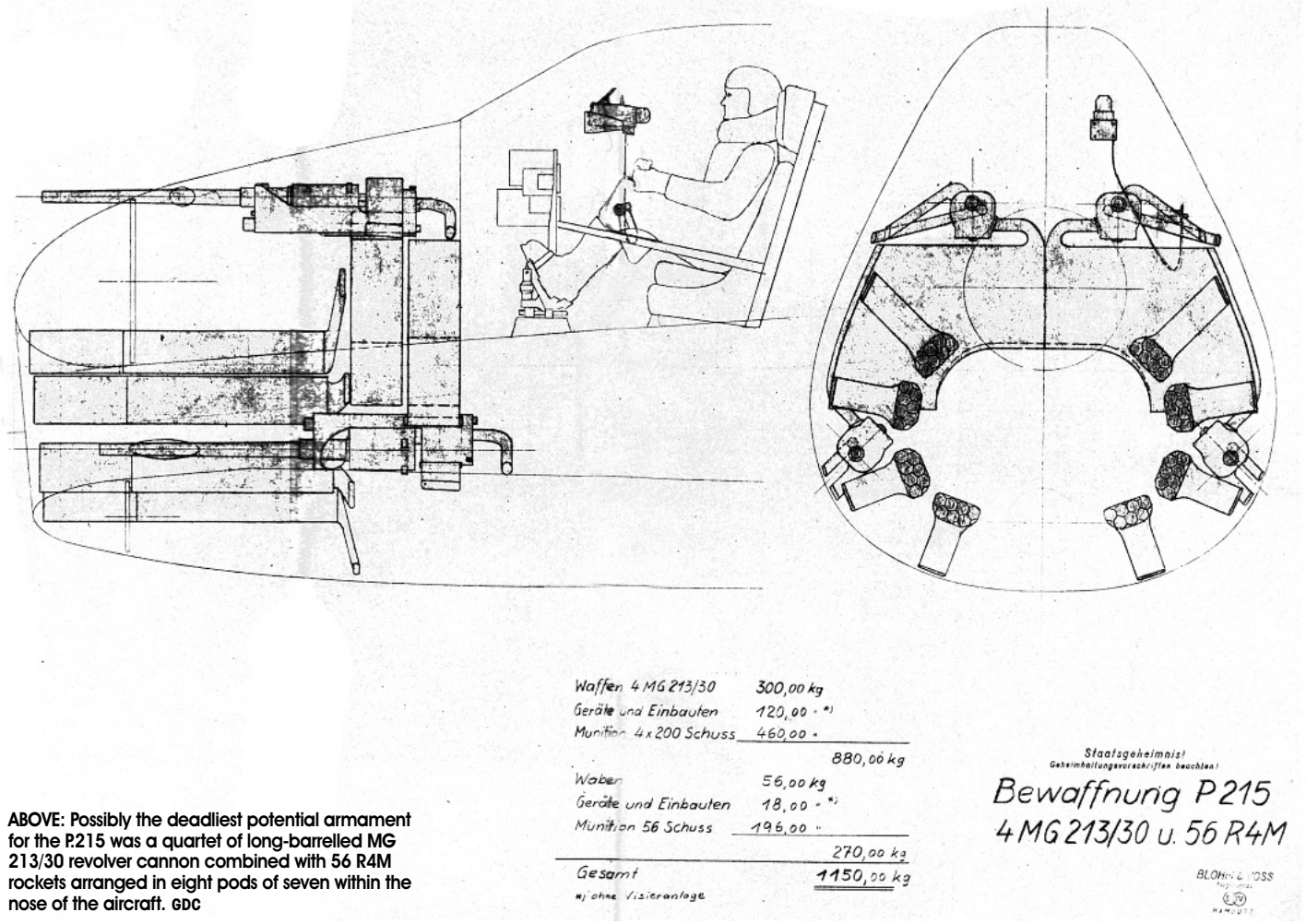
ABOVE: A novel mechanism was proposed for the P.215 which would have allowed its pilot to tilt its five MK 108 cannon upwards by an angle of up to 15 degrees while in level flight. Useful for attacking a bomber formation from behind and below but with a penalty of reduced ammunition for each gun. GDC



ABOVE: The 'option D' armament for the P.215 was two enormous MK 112 cannon with 50 shots each. The MK 112 was a scaled-up MK 108 which did not see service before the end of the war. GDC



ABOVE: Detailed side view of the P.215 from the brochure showing bubble canopy with 'back-seater' positioned higher up than in other views. GDC



ABOVE: Possibly the deadliest potential armament for the P.215 was a quartet of long-barrelled MG 213/30 revolver cannon combined with 56 R4M rockets arranged in eight pods of seven within the nose of the aircraft. GDC

the load bearing structure. The outer ends in the aileron area are fed warm air from the engine for de-icing."

The landing gear consisted of a He 219 nosewheel, according to the brochure, and large mainwheels which tucked up neatly inside the fuselage.

Then came the weapons. The normal 'attack' armament (option A) was to be five MK 108 cannon with 200 shots each. This could be exchanged for (option B) five MK 108s with 150 shots each that could be tilted upwards at an angle of between 0 and 15 degrees.

Option C was six MG 213/30s with 200 shots each. Option D involved the installation of two massive MK 112 cannon with 50 shots each. Finally, option E allowed for no fewer than 56 R4M unguided rockets to be installed in the P.215's nose – alongside either four MK 108s, four MG 213/30s or two MK 212/214s.

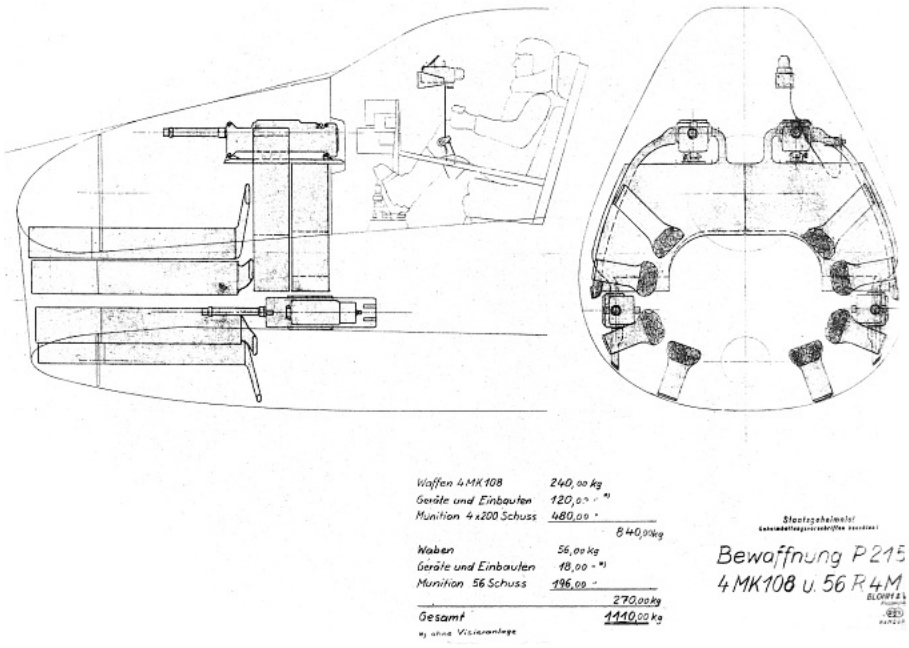
And this was only the forward armament. The P.215 also came with a pair of MK 108s aimed rearwards that could move in an 80 degree arc for defence and the option to carry a pair of 500kg bombs semi-recessed within the fuselage.

While the MG 213/30 revolver cannon and MK 108 are relatively well known, it is worth looking in more detail at the MK 112. This was essentially an up-scaled MK 108 which fired 55mm projectiles weighing 1.5kg (3.3lb) each.

While the destructive potential of such a weapon was enormous if it could score a hit, the downside was the MK 112's ponderous rate of fire – 300 rounds a minute like the MK 108 – and its low muzzle velocity, which was only slightly better than that of the MK 108.

Even more deadly would have been the 56 R4M rockets, gathered in eight pods of seven within the aircraft's nose. Each one weighed 3.2kg and contained 520g (1.1lb) of explosives. A single hit with an R4M was likely to be enough to shoot down a bomber.

None of this was sufficient to impress Focke-Wulf mechanic H Wolff, however, who wrote of the P.215: "The thick short fuselage causes large Mach number influence; the long intake duct at the TL unit (6m) gives a boost loss of 4%." Contrary to the claims of the official P.215 brochure, Wolff wrote that the likely service ceiling of the type would be 9km, rather than 10km, due to "the thin wing profile at the root". ●

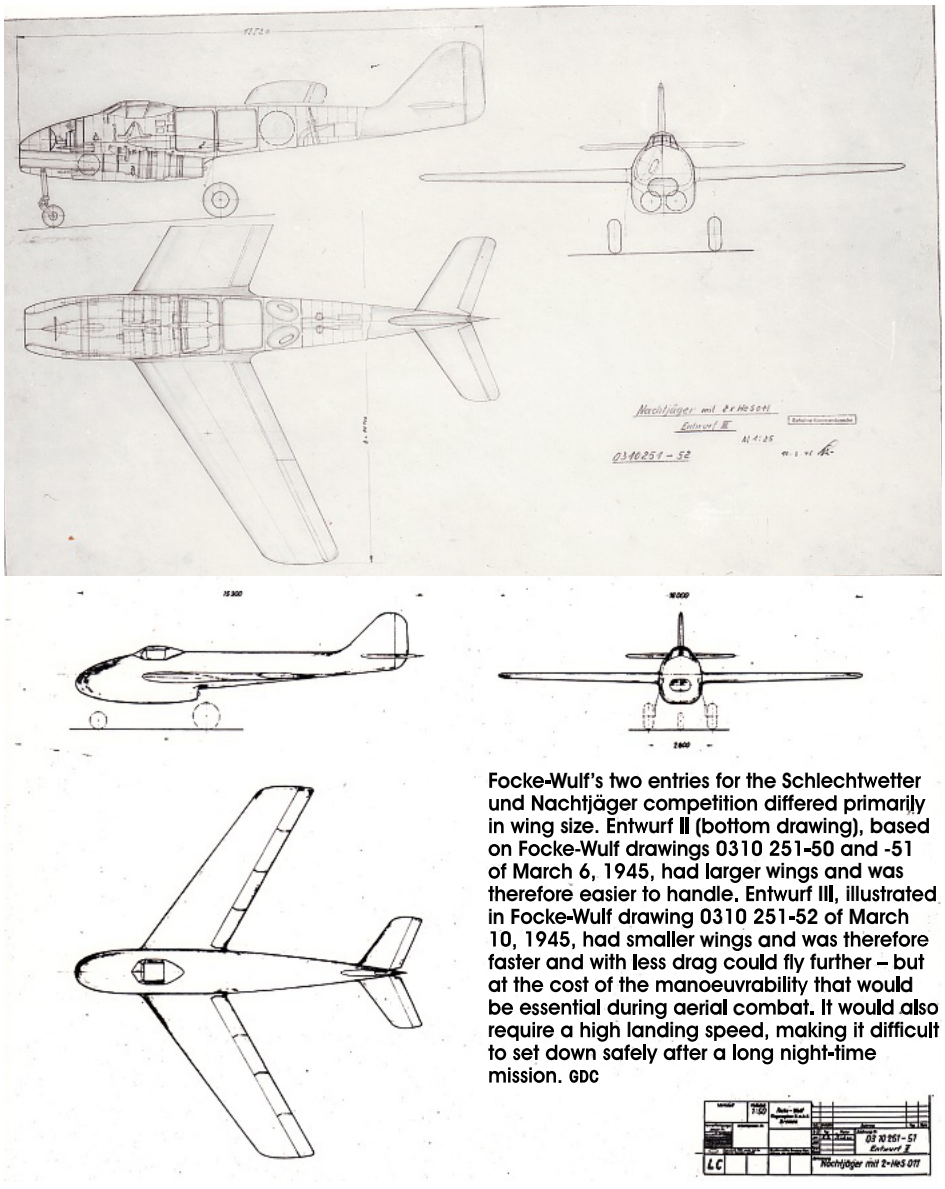


ABOVE: Since the MG 213/30 was still in development, had a decision been made to rush the P.215 into production, it would most likely have ended up with this armament – four MK 108s and 56 R4M rocket. GDC

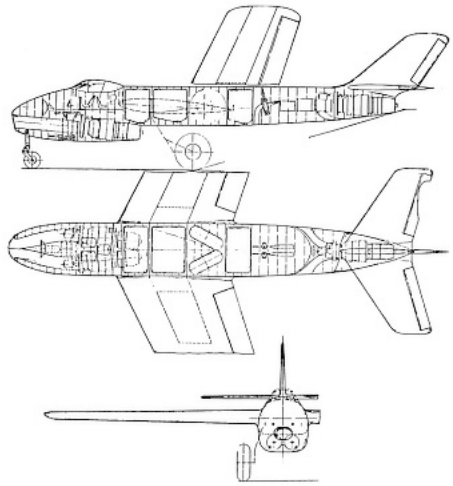
II and III, P.256

Schlechtwetter und Nachtjäger – Focke-Wulf and Dornier

Focke-Wulf undeniably felt aggrieved at the requirements set out for the bad weather and night fighter competition – particularly the need to carry a large equipment load over long distances. Its own offerings for the contest, Focke-Wulf II and Focke-Wulf III, emphasised fuel efficiency.



Focke-Wulf's two entries for the Schlechtwetter und Nachtjäger competition differed primarily in wing size. Entwurf II (bottom drawing), based on Focke-Wulf drawings 0310 251-50 and -51 of March 6, 1945, had larger wings and was therefore easier to handle. Entwurf III, illustrated in Focke-Wulf drawing 0310 251-52 of March 10, 1945, had smaller wings and was therefore faster and with less drag could fly further – but at the cost of the manoeuvrability that would be essential during aerial combat. It would also require a high landing speed, making it difficult to set down safely after a long night-time mission. GDC



ABOVE: Another variation on the theme. Focke-Wulf V from drawing 0310 251-54 had two turbojets in its nose and another one right at the far end of its tail, inside the fuselage. TNA

During November 1944, Focke-Wulf carried out a design study on a single-seat twin-jet fighter and fighter-bomber – the Zweimotoriges TL-Jagdflugzeug mit HeS 109-011.

This innovative design, outlined in Kurzbeschreibung Nr. 23, grouped both engines together in the forward lower part of the fuselage.

According to the report, "compared to the single-engine TL-fighter, this combines better flight performance and stronger throttling capability with the possibility of carrying a bomb of up to 1000kg weight in the fuselage.

"The stronger throttling capability results from the combined propulsion of two closely juxtaposed in-fuselage turbojet devices, one of which can be turned off while cruising without the aeroplane being forced to make rudder deflections and thus sliding angles."

All the type's fuel was to be carried in its fuselage. Within the report, Focke-Wulf offered data from a previous project, Höhenjagdflugzeug mit BMW 109-018, which apparently outlined the speed benefits of having two engines working so closely together.

Kurzbeschreibung Nr. 23 was issued on November 23, 1944, and was still fresh in its designers' minds when they were asked to come up with designs for the Schlechtwetter und Nachtjäger contest just over a month later.

With this as 'Focke-Wulf I', they came up with a series of four more designs which pushed the basic layout of the type to its limits. Focke-Wulf II and III were very similar except the former had longer wings and was more manoeuvrable, while the latter had smaller wings and was faster with greater range.

Focke-Wulf IV had three turbojets but with just one under the forward fuselage – the other two being in pods under its wings. Focke-Wulf V also had three engines but supplemented the usual two up front with a third inside its tail, fed by intakes on either side of the fuselage.

The IV and V designs were purely for comparative purposes and could not have been

ABOVE: It would have taken a miracle for the Dornier P.256 to win the competition and enter service but it would nevertheless have made a surprisingly handsome addition to the Luftwaffe fleet. Art by Chris Sandham-Bailey

entered into the competition. II and III, however, were entered.

Focke-Wulf II had a conventional tail with swept-back single spar wings featuring normal flaps and ailerons. The fuselage nose was bulbous and housed the two HeS 011 turbojets positioned side by side but slightly angled within the fuselage. This created a space between them for the nosewheel of the tricycle undercarriage.

The pressurised cockpit housed three crew sitting on ejection seats and behind this were two self-sealing fuel tanks. Armament was four fixed forward-firing MK 108s and two more firing upwards. Wingspan was 51.8ft, with a wing area of 538sq ft. Top speed at 23,000ft was 565mph and maximum endurance was two hours and 45 minutes.

Focke-Wulf III was the same but with larger main undercarriage wheels, a wingspan of 46.3ft, with a wing area of 431sq ft, a top speed of 586mph at 19,700ft and maximum endurance of two hours, 48 minutes.

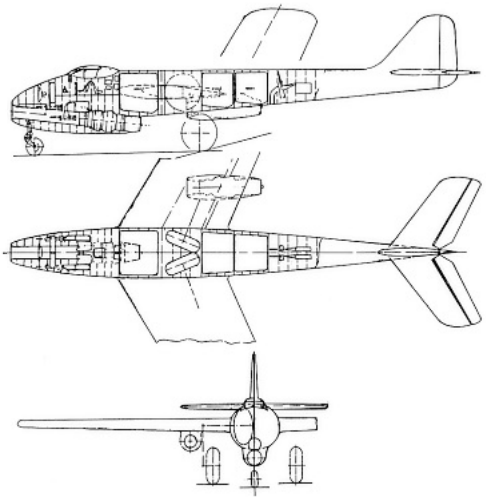
Focke-Wulf's mechanic H Wolff had some surprisingly negative comments to make of his own firm's ideas: "The smaller winged aircraft has too high a surface load and therefore a large landing speed. The engines can be expected to lose 2% thrust."

DORNIER P.256/1

Dornier's designers must have been horrified when they saw what their P.256/1 was up against in the Schlechtwetter und Nachtjäger competition. The other entries – flying wings, swept-wing and tailless types – made their conventional design appear decidedly dated.

The P.256/1 was derived from the Do 335 fighter and had the specified three crew members, two in the cockpit at the front, pilot and navigator, seated side by side and the other, the radar operator, in a separate compartment within the fuselage.

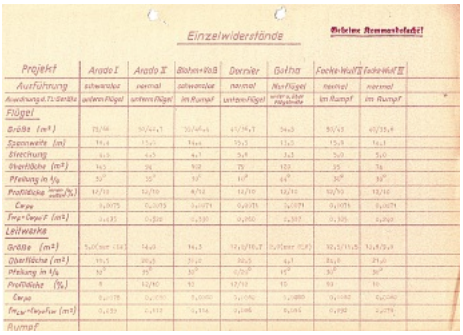
The wings were unswept and the two HeS 011 turbojets were housed in pods beneath them. There were three fuel tanks between the two crewmen at the front and the 'back seater' and the aircraft had a tricycle undercarriage. Armament was f our MK 108s firing forward and two more firing upwards. Top speed was an underwhelming 515mph.



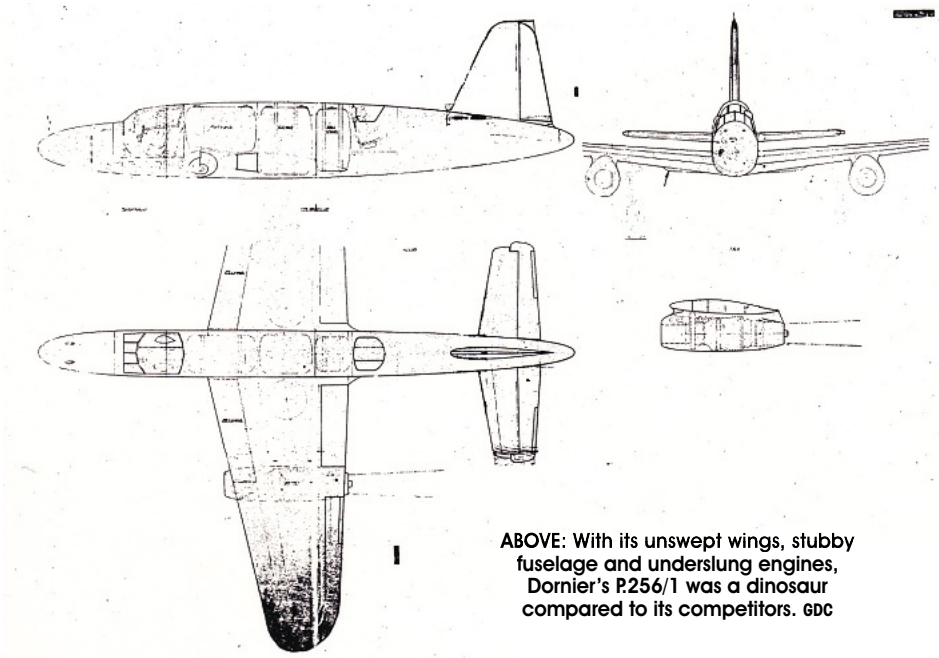
ABOVE: The Focke-Wulf IV, shown in Focke-Wulf drawing 0310 251-53, was designed with three turbojets instead of two – making it ineligible for the competition but providing useful comparative data. It had one in its nose and the other two under its wings. TNA

Focke-Wulf's H Wolff was typically scathing: "The unswept wings are taken from the Do 335, the unfavourable engine nacelle structure will result in high interference. The trunk is short and the tail is conspicuously large because of the small wing to tail distance.

"The Dornier project falls sharply out of contention because of the unswept wing and the unfavourable gondola suspension of the engines." ●

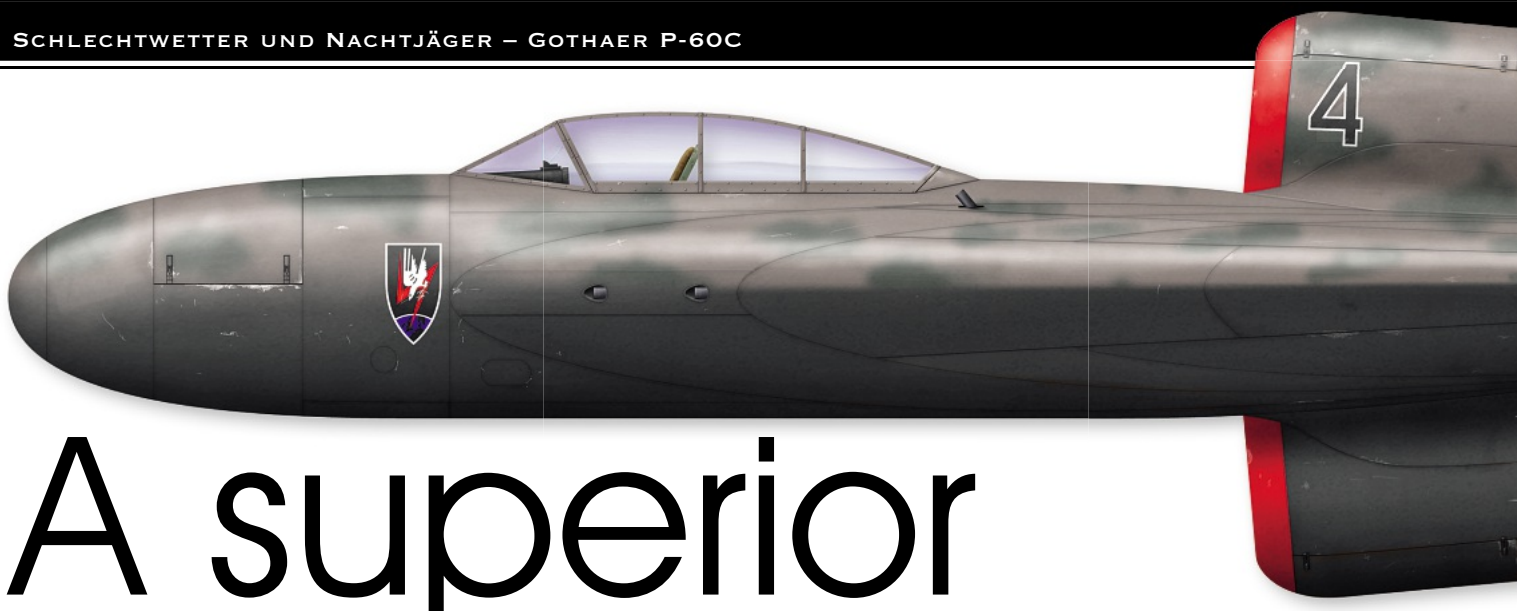


ABOVE: Focke-Wulf document showing the seven advanced night fighter competitors. GDC



ABOVE: With its unswept wings, stubby fuselage and underslung engines, Dornier's P.256/1 was a dinosaur compared to its competitors. GDC

ABOVE: The long-tailed Focke-Wulf II design as it might have appeared in service. Art by Chris Sandham-Bailey



A superior flying wing

Schlechtwetter und Nachtjäger – Gothaer P-60C

Designs for an advanced jet aircraft, the Horten 8-229 flying wing, fell into the lap of Gothaer Waggonfabrik (GWF) in July 1944 and it quickly set about using this data to design a rival flying wing which would become a front runner in Germany's last jet aircraft competition.

By the summer of 1944 the twin-jet engine Horten IX single-seat flying wing fighter/bomber was almost ready to enter series production.

Its designers, brothers Walter and Reimar Horten, had struggled to gain acceptance for the project, despite being given a 500,000 Reichsmark contract by Hermann Göring himself in late September 1943 to design and build three Horten IX prototypes.

A month later, Generalfeldmarschall Erhard Milch had decided against giving the Horten IX the highest production priority rating, making it harder for the brothers to obtain the materials and components they needed.

From the end of October 1943 to early June 1944, the Hortens managed to construct a working glider prototype of the Horten IX and had assembled another with housing for its two jet engines. They continued to face delays however.

At this point though, the Waffen-SS took an interest in the project. The SS had accumulated sufficient power by now to sponsor its own aviation projects, particularly those that it felt furthered its goal of waging 'total war' on the enemies of the Third Reich.

The radical flying wing shape of the Horten IX and its projected high performance appeared to be exactly what it was looking for. A meeting on June 15, 1944, between the SS and the RLM resulted in an immediate order for 10 Horten IXs and the type being given the official RLM designation 8-229.

Two contractors were chosen to build these aircraft – since the Hortens' company lacked the necessary infrastructure – Klemm Technik at Stuttgart-Böblingen and Gothaer Waggonfabrik. Unfortunately, the former was much better at attracting contracts than it was at fulfilling them and within two months all 8-229 assembly work had been passed to Gothaer. The contract was enlarged to the construction of 30 aircraft.

The project encountered a major stumbling block on July 20, 1944, when 80% of the Gothaer factory at Gotha was destroyed in an air raid. Production then had to be dispersed to seven smaller facilities – which took time.

Nevertheless, work was progressing on the first Gothaer-built 8-229s. The more the company's engineers worked on the aircraft, however, the more flaws they found in its design. The most serious was the location of the centre of gravity, which had to be shifted significantly to provide the aircraft with the necessary stability.

This involved moving the location of the engines, reducing the proposed armament from four MK 108s to just two, adding a huge armour plate, adding ballast and altering the aircraft's internal structure several times. The cockpit had to be redesigned to better accommodate the pilot's head too, and the proposed ejection seat was too weak.

With all this in mind, Gothaer chief aerodynamicist Dr Rudolf Goethert, who had previously worked at the LFA for seven years specialising in wing design, controls and stability, set out to design a better flying wing which would correct all the mistakes he perceived as having been made by the Hortens.

Interviewed by the Americans on June 28, June 30 and July 5, 1945, Goethert said that his company had "started building the V6 and made detailed drawings for the V7 and V8. The GWF were reluctant to continue production of the 229, however, because they believed they could design a superior flying wing".

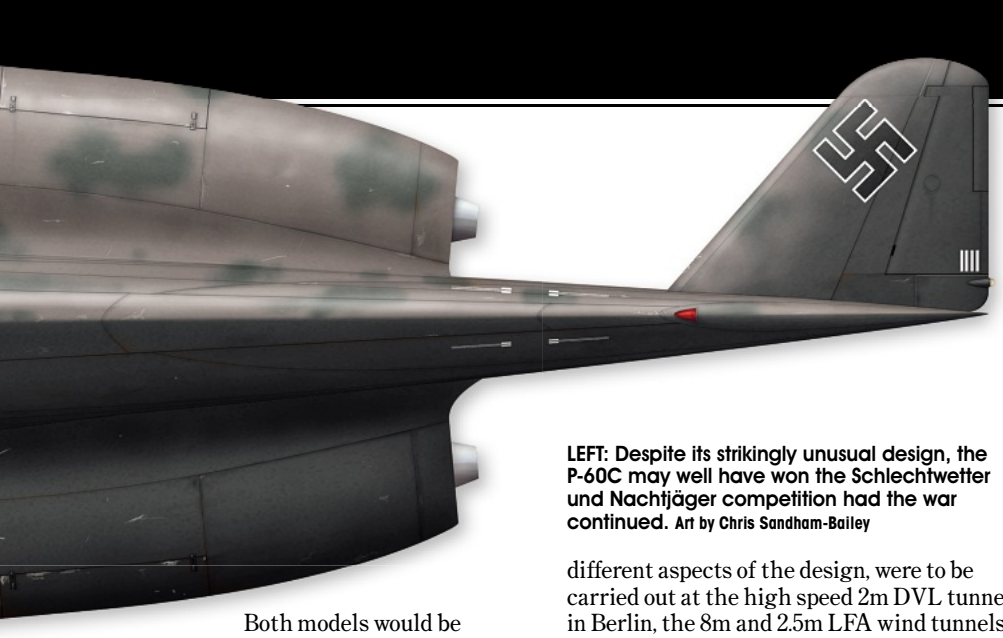
THE FIRST TWO P-60S

The flying wing design produced by Goethert was known as the Gotha P-60. The first version, the P-60A, was to be powered by two BMW 003 jet engines and its crew consisted of a pilot and an observer, both lying prone in the aircraft's cramped nose cabin.

The P-60B was an improved and slightly larger design which was to be powered by two Heinkel-Hirth 011 engines. The crew of two were positioned the same way.

The engines of both were mounted externally in faired housings at the rear of the centre section, one above and one below. According to the American report on the interview with Goethert, Technical Intelligence report I-68, "An alternate design with the engines partially buried side by side in the undersurface of the centre section was proposed for the P-60A, but only to obtain wind tunnel data for application to possible future designs of larger flying wings.

"In addition, a Walter type rocket engine of 2000kg thrust could be added to any of the models for use in take-off and climb. Dr Goethert stated that this engine would not be used for high speed because the speed increase would not be large."



LEFT: Despite its strikingly unusual design, the P-60C may well have won the Schlechtwetter und Nachtjäger competition had the war continued. Art by Chris Sandham-Bailey

Both models would be equipped with a pressure cabin.

Again, according to the report: "The P-60B was not entered into the day fighter competition because the requirements for the day fighter included that it have only one turbo-jet engine. However, a comparison of the performance of the P-60B with the 229 showed it to be the superior aircraft.

"The P-60A has slightly less drag than the Ho 229, but the BMW 003 engine has slightly less thrust than the Jumo 004 and consequently the high speed at sea level is approximately the same.

"At higher altitudes the high speed of the P-60A is considerably higher because the critical Mach number of the P-60A is higher."

P-60C NIGHT FIGHTER

Having designed the first two P-60s and having sent the RLM his comparison between the P-60 and the Hortens' 8-229, Goethert next decided to radically modify his P-60B to create a Gotha entry for the Schlechtwetter und Nachtjäger competition of January 1945.

In order to accommodate the necessary 3ft diameter radar scanner, the nose was extended and the crew were relocated to sit upright – the pilot in the centre beneath a normal canopy and the other two crewmen, navigator and radar operator, on either side and to the rear of him in enclosed compartments within the wingroots.

A pressure cabin was included in the design, as were ejection seats for all three crewmembers – the streamlined wing panels above the navigator and radar operator being capable of being jettisoned in the event of an emergency.

The upthrust cockpit caused stability problems, however, and Goethert was forced to include a pair of vertical fins in the design to compensate.

Armament was four fixed forward-firing MK 108 30mm cannon and two more set to fire upwards at an oblique angle from within the fuselage behind the two 'back-seater' crewmen.

The wind tunnel programme for the P-60 series had been started by the time the night fighter competition got under way. Tests on the location of the engine nacelle had been run at Göttingen and Dr Goethert had received some of this data. Models for the remainder of the wind tunnel programme were under construction.

Goethert told his captors that this programme, a series of tests each involving different aspects of the design, were to be carried out at the high speed 2m DVL tunnel in Berlin, the 8m and 2.5m LFA wind tunnels at Braunschweig, and again at Göttingen.

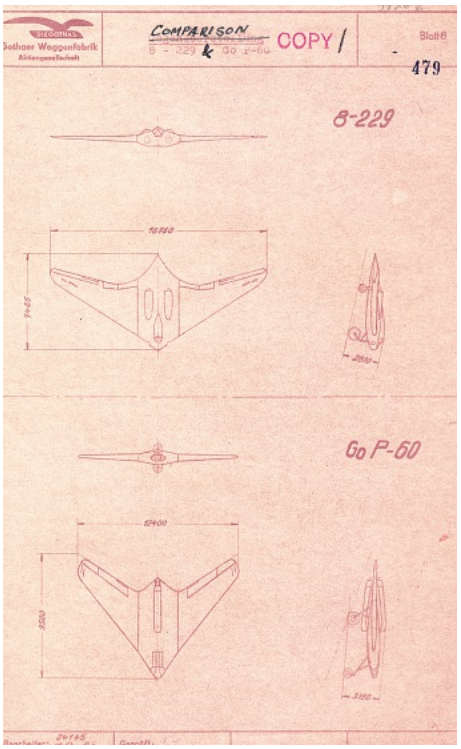
The low esteem in which Goethert held the Horten brothers is illustrated by the designer's next revelation: "The Gotha firm had also planned to make flight tests on the 229 to obtain data for use on the P60. These tests would include the determination of neutral points, the effect of sweepback on lateral stability, tests of various types of rudders, such as drag rudders – some of these tests may have been run on the Horten VII – and tests of landing flaps etc."

At the EHK conference on night fighters held at Bad Eilsen on March 20-21, 1945, the Gotha P-60C, along with the tailless Arado I and Blohm & Voss P.215 designs were chosen as competition finalists.

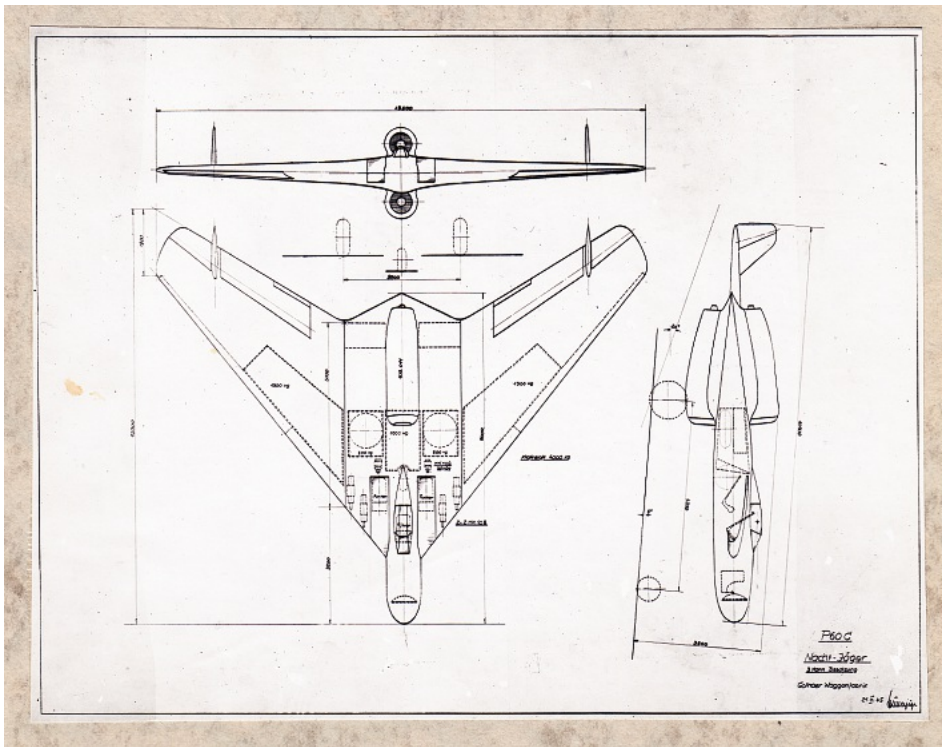
According to the American report: "[Goethert said] the P-60C was shown to have the best performance of these aircraft, and Dr Goethert believed it would have won had not the war disrupted the competition."

In his comments on the design, Focke-Wulf mechanic H Wolff noted: "The Gotha P-60C has the smallest surface area of all the projects. Large centre effect was unavoidable due to the greatly enlarged chord. The engine intakes are at risk because of the large run-up distance." He also acknowledges that the P-60C was the fastest of the projects and the fastest climbing.

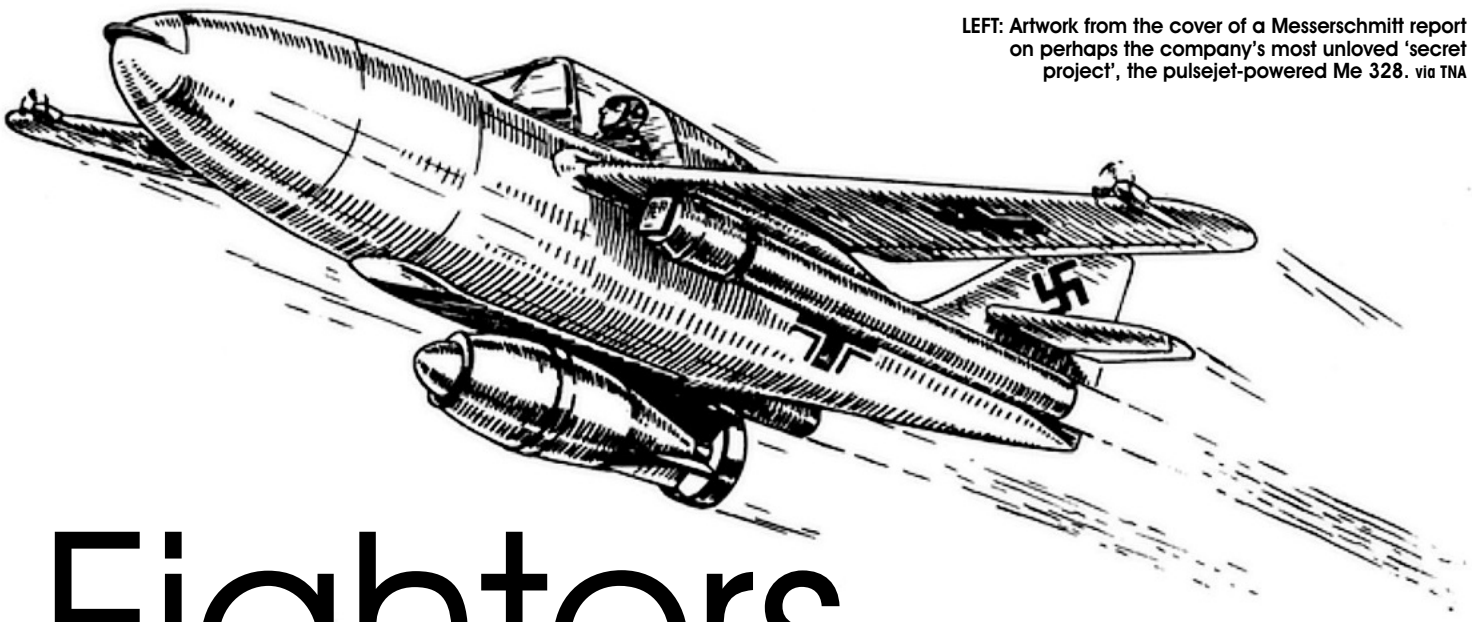
This seems to amount to a grudging confirmation of Goethert's claim – against all the odds, the P-60C was the best of the big night fighters. ●



ABOVE: It would be too simplistic to say that, having been contracted to build the Horten brothers' 8-229 flying wing, Gothaer decided to beat them at their own game, but the firm certainly attempted to show that its 'in-house' P-60 was superior with comparisons such as this from a contemporary Gothaer document. GDC



ABOVE: The heavily-armed sharply-swept Gotha P-60C flying wing as pictured in a contemporary German report. GDC



LEFT: Artwork from the cover of a Messerschmitt report on perhaps the company's most unloved 'secret project', the pulsejet-powered Me 328. via TNA

Fighters on a budget

Messerschmitt Me 328 and other pulse jet proposals

Early plans to power the Me 262 and He 280 with cheap Argus As 014 pulse jets came to nothing but Messerschmitt persevered with the low cost power plant, used successfully on the V-1 flying bomb, and in late 1944 other companies began to give it serious consideration.

Messerschmitt had been attempting to build a cheap wooden fighter aircraft since 1941 under the project number P.1079. This was subsequently given the RLM type number Me 328.

Three versions were initially proposed: an unpowered glider, a turbojet-powered fighter and a fighter powered by one or more Argus As 014 pulse jets.

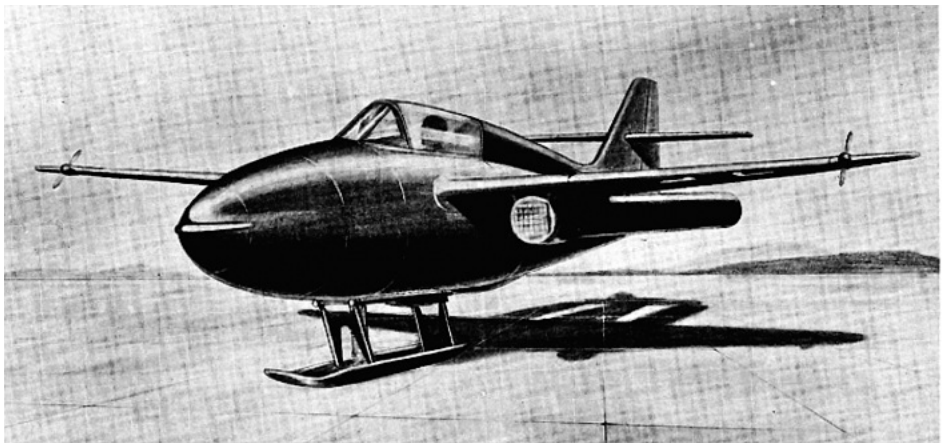
The pulse jet, patented by engineer Paul Schmidt in 1931, consisted of a simple tube of mild steel with a set of shutters over the intake at the front and a fuel inlet valve and igniter inside. Engine company Argus built the As 014 and a larger version with a square-shaped intake, the As 044.

Started using blasts of compressed air to the intake, the engine was allowed to build up to a minimum operating temperature before this was removed. The clever design of the engine then kept it firing. A single pulse started with the shutters open. Fuel was then injected into the tube and ignited, causing a rapid expansion of gases which snapped the spring-loaded shutters closed and forced the gases to blast free from the other end of the tube, creating thrust.

Once the pressure from this blast had subsided, there was nothing to hold the shutters closed and they snapped open again – allowing air to be sucked in and the cycle to repeat. This happened 45-55 times per second.

Within months of the Me 328 project's commencement, the glider and turbojet versions were dropped and all efforts focused on utilising the As 014. Two versions were now proposed – the Me 328A, which was a single-seat fighter that was to be towed aloft, and the Me 328B, a fast bomber.

Each was to be powered by a pair of pulse jets and a wide variety of different attachment points for these engines were considered – for example, one under each wing, one over each wing, one attached either side of the tail, one attached either side of the tail but with the intakes faired into the tops of the wings and so on.



ABOVE: The Me 328 with skid extended. via www.deutscheluftwaffe.de

On December 14, 1942, the Me 328A was abandoned and efforts were focused on the Me 328B. Since Messerschmitt's design teams were fully committed to the Me 262, Me 163, Me 209, ongoing development of the Bf 109, and the disastrous Me 210, little progress was made however.

In 1943 the project was handed over to the DFS for further development. Unfortunately, the DFS lacked the resources to press ahead and even by May 1944, Me 328 V1 existed only as a glider. Even that had been built to a low specification since the necessary materials for the required structural strength could not be procured.

At the beginning of June 1944, the project was moved again, this time to Gothaer Waggonfabrik. At this stage, test flights of the Me 328 V1 commenced, with the airframe mounted on the back of a Dornier 217 carrier aircraft. Ground tests with the As 014, however, revealed that it produced an unacceptable level of vibration – such that it would eventually cause the lightly-built airframe to suffer structural failure.

Glider tests of the Me 328 were halted shortly after the commencement of operations with the Fieseler Fi 103 V-1 flying bomb – the first and only successful use of the As 014 – and the project was abandoned.

Three months later, however, interest in the pulse jet as a fighter engine was rekindled in the wake of the Volksjäger contest. With its emphasis on low cost and ease of construction, it had focused the efforts of competition runner-up Blohm & Voss on cheap alternatives to turbojet-powered fighters.

Therefore, in around October 1944, the company began work on designs for a small fighter along the same lines as its failed P.211 Volksjäger but utilising the pulse jet as its powerplant.

It has been suggested that the RLM issued a requirement for a 'miniature fighter' powered by the As 014 at this stage, but there is insufficient evidence to support this.

BLOHM & VOSS P.213

In a brochure published on November 10, 1944, Blohm & Voss outlined a typically unconventional proposal for a "miniature fighter with As 014".

The introduction states: "Examining the proposal for a small fighter design with the Argus-Schmidt-thrust tube As 014 has revealed that with a single large-calibre weapon, 350kg fuel and with a minimum set of equipment (a radio set was omitted entirely) the take-off weight can come to 1280kg.

"That's about half the size of the smallest fighters previously presented. Taking into account not only the comparative value of the airframes, but also the comparative production costs of the two engines – in one case, a high-quality compressor and turbine unit, and in the other the few hours of work required to make the tube – then the pursuit of this line of thought seems to be quite lucrative.

"Again, we were guided by the design ideas of our small fighter P.211 with the entire hull mounted on the inlet pipe to invert the fuselage. The smaller the space dimensions, the more advantageous is the construction. A new feature of the project described here is the position of the wing on the fuselage boom."

In the next section, the brochure describes the aircraft's wings being constructed as a single component which would be fitted directly onto the top of the "correspondingly shaped" fuselage then fastened on with screws. For the tail, the brochure suggests that a "steep upward V-shape must lead to undesirable properties and impairments" but fitting the V-tail the other way up, it says, entirely cures this problem.

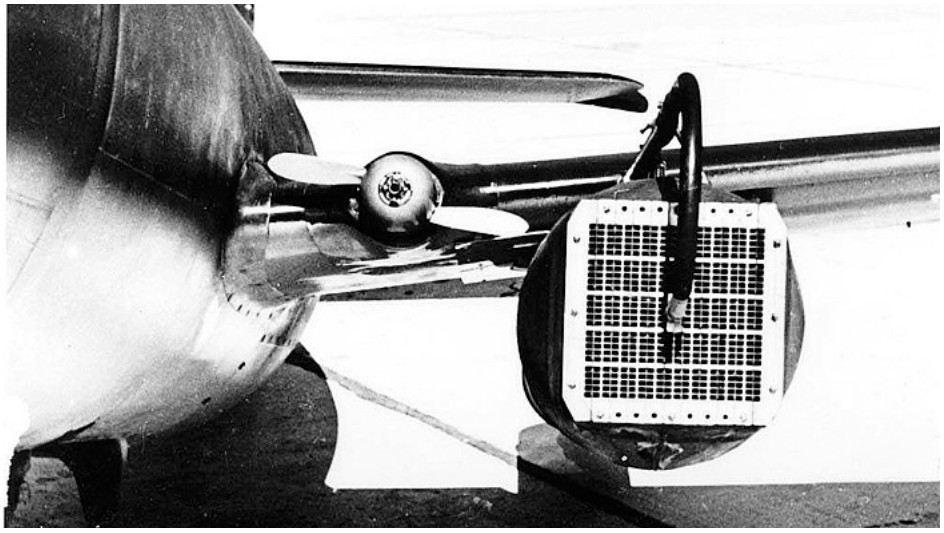
It is also careful to point out that the upside down V-tail would not compromise ground clearance.

Next, the real secrets of the P.213's incredibly light weight are revealed: "The air inlet pipe is the hull girder and at the same time the mounting frame for all the equipment. The pipe carrier extension grows out, under which hangs the tube, and at the same time forms the tail."

In other words, the pulse jet's hollow metal intake tube was actually to be the main structural component of the whole aircraft. Everything else, made of mostly of wood, would be bolted onto it. The hollow welded steel boom necessary to attach the pulse jet to the rest of the aircraft would be both the aircraft's tail and also its fuel tank – holding 420 litres.

As the brochure notes: "This accommodation option is much less problematic than the other existing possibility of storage in impregnated wood wings."

The P.213's undercarriage main wheels would be mounted on the fuselage and would swing forwards into it. However, the Blohm & Voss brochure then states with unusual candour: "We are still not entirely clear about what power supply should be used to retract the wheels. ▶



ABOVE: A close-up of an Argus pulse jet as fitted to the Me 328. via author

BELOW: Although fitted with Argus tubes for ground tests, it is believed that no Me 328 airframe ever flew under its own power. via author

"Since the engine cannot supply any generator power, and a battery would be too heavy, we have considered a small compressed air tank.

"This seems to be a potential solution because compressed air has to be available in any case for loading the weapon. We have also consider the possibility of a hand crank for retracting the wheels. The nose wheel sits under the fuselage pylon and is rotated flat during retraction."

The brochure proposes to overcome the As 014's notorious vibrations by fitting a "sufficiently wide rubber sleeve" between the inlet pipe running through the fuselage and the intake of the engine unit itself. The engine was attached to the boom above it with a bracket welded "like a wall bracket on top of the tube".

In terms of equipment and armament, no equipment was offered and only a single MK 108 30mm cannon, fitted in the nose of the fuselage with its rear end between the pilot's feet. Its ammo box would sit directly on top of it.

A significant drawback of the P.213 design is scarcely mentioned in the brochure – only towards the back are brief figures given for the type's performance on take-off. Even with its incredibly light weight, the aircraft would still require 910m or 3000ft to get off the ground unassisted. This was not impossible, and not even dissimilar to the take-off run of a Me 262, which needed more than 1000m, but it was still undesirable.

Unlike ramjets, pulse jets do generate thrust even when static. However, they operate best at speed. The V-1 flying bomb had to be launched into the air at high speed because its stubby wings had a very high stall speed, not because no thrust was available, and the P.213 had a similar problem.

The brochure also gives a figure for take-off with an additional 500kg of thrust a much more acceptable 360m or 1180ft. No details are given as to how the extra thrust would be provided but presumably solid fuel booster rockets would have been used rather than a catapult.

JUNKERS EF.126 'ELLI'

Conceived at the same time as Junkers' rocket-powered interceptor, the EF.127 'Walli' in early 1944, the EF.126 loosely resembled a manned V-1 with the pilot seated in its nose. According to the British report German Aircraft: New and Projected Types: "This project was intended as a ground-attack aircraft and developed on similar lines to the Fi 103 flying bomb.

"It is a single-seat, mid-wing monoplane of composite construction with a single Argus 014 propulsive duct having a sea level static thrust of 1100lb. A conventional undercarriage and a landing skid were both to be tried.

"Take-off is by winch or assisted take-off rockets. Armament comprises two MG 151/20s and two AB 250 bomb containers, or, 12 'Panzerblitz' rocket projectiles."

In the same report, discussing minutes of an EHK meeting on November 21-22, 1944, it states: "Miscellaneous jet-propelled aircraft. The Junkers EF.126 project, described in the present report as a ground-attack aircraft, was mentioned at the meeting as a heavy fighter with one or two Argus impulse duct units. Its future depended on Junkers' production capacity."

Numerous other types at mentioned at the meeting, but no mention is made of any competition for a pulse jet fighter.

In the minutes of another EHK meeting presented in the British report, this time one held on December 22, 1944, in a section marked 'small aircraft with Argus tube', it is says: "Professor Heinrich Hertel of Junkers stated that his company proposed a very cheap and simple single-seater with an Argus tube power unit (109.014), intended for ground attack operations (N.B. this aircraft is described in the present report as the EF.126). The German Air Force considered the range of 280-310 miles and the endurance of 40-50 mins to be completely impracticable.

"However, no objection could be taken to a development of this very interesting and economical aircraft for experimental purposes, but with no intention of quantity production."

Again, while other competitions and competitors are mentioned in the minutes, it seems there were no competitors for the EF.126. However, a third company was also working on a pulse jet design – Heinkel.

HEINKEL 'ROMEO'

While Heinkel's rocket-powered P.1077 'Julia' design was under consideration as a target defence interceptor, the company had apparently also produced a proposal for a pulse jet-powered version under the name 'Romeo' – the Shakespeare tragedy being known as Romeo und Julia in Germany, rather than the English Romeo and Juliet.

Contemporary sources do not mention the 'Romeo' design and it appears only in postwar literature. However, the design presented is convincing. In any case, 'Romeo' appears never to have been submitted to the RLM for consideration.

After 'Julia' itself was cancelled, however, Heinkel began to consider the As 014 or 044 as a cheaper alternative powerplant for its He 162.

HEINKEL HE 162 WITH ARGUS TUBE

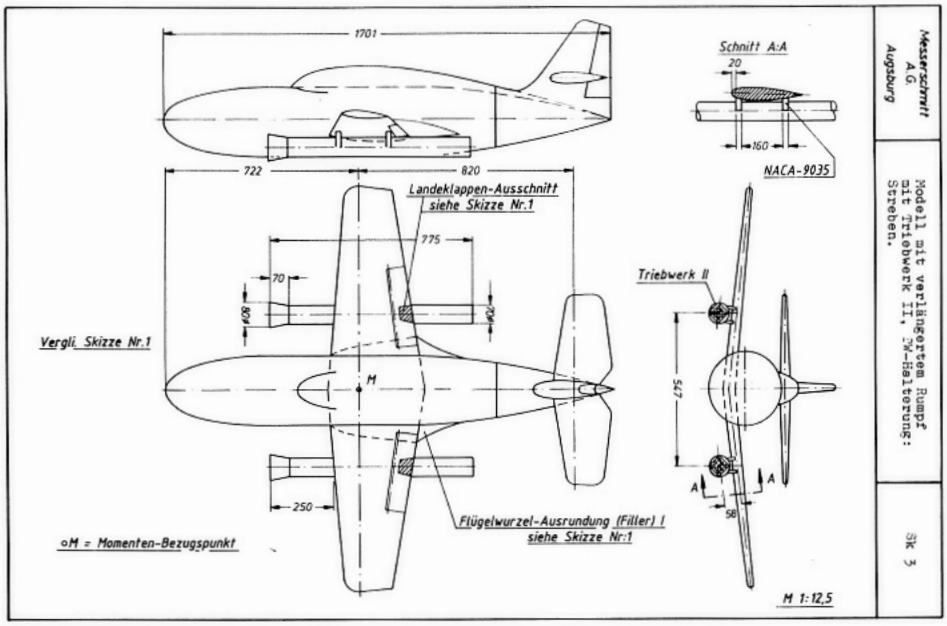
On March 30, 1945, with the He 162 about to enter front line service after a series of interminable delays, many of them down to engine production and fitting difficulties, Heinkel issued a report on its work towards the possibility of a pulse jet-powered version of the aircraft.

It states: "The occasion for investigation of the 162 with Argus tubes was the considerably lower cost of producing the Argus tubes in comparison with the TL power unit.

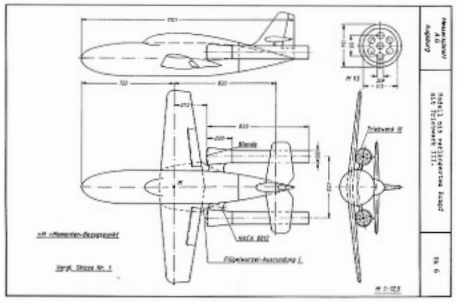
"The drawbacks are the great fuel consumption, low altitude output and the necessity for a supplementary starting aid. The velocities at lower altitudes, however, are but slightly inferior to the value attainable with TL units.

"We have the choice between different size Argus tubes, the As 014 tube with 335kg static thrust and the As 044 tube with 500kg static thrust. We investigated the employment of two As 014 tubes above the fuselage, and also of one As 044 tube similarly placed."

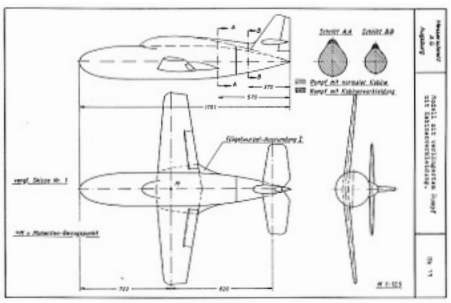
In an earlier report, given as number 114/44, the same author had apparently previously recommended an arrangement utilising the 014. Since then, however, it appears that the 044 had been improved and now produced more thrust.



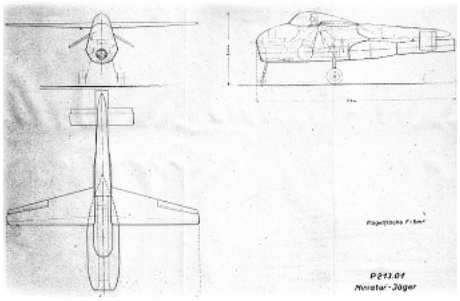
ABOVE: Numerous different arrangements of pulsejets were sketched out for the Me 328 project but none of them were entirely satisfactory. via author



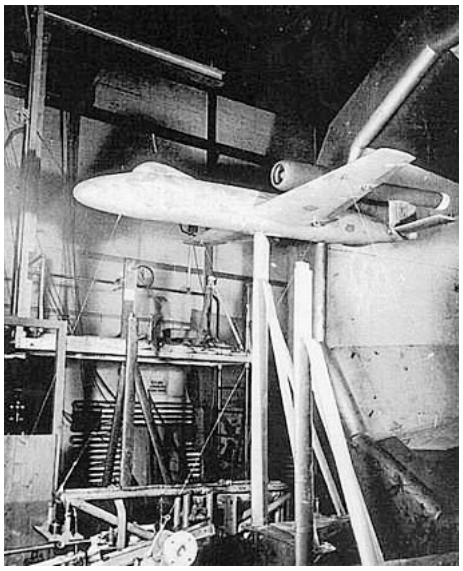
ABOVE: Another pulsejet arrangement, this time with larger engines positioned on the aircraft's tail. via author



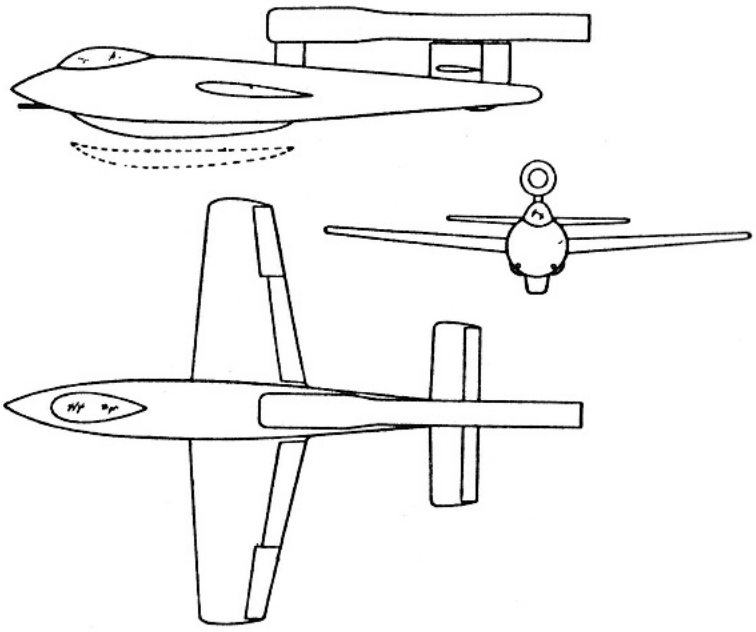
ABOVE: A diagram showing possible alterations to the Me 328 wings and fuselage. The engines have been omitted for clarity. via author



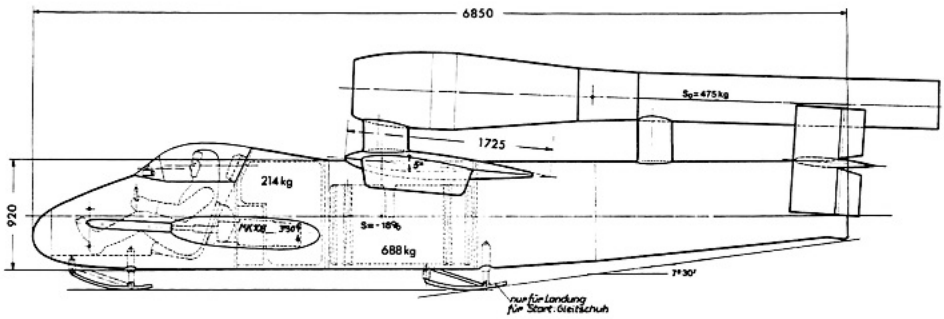
ABOVE: Blohm & Voss's P.213 'miniature fighter with As 014' pulsejet proposal was based on studies carried out for the company's low-cost Volksjäger design, the P.211. GDC



ABOVE: Early wind tunnel tests photos show a Junkers EF.126 design with rounded nose and a short, straightforward tail. via author



ABOVE: A simplified three-view of the Junkers EF.126 pulsejet ground-attack or fighter aircraft. Categorised by the EHK under 'miscellaneous', the EF.126 had an apparently charmed existence. TNA



ABOVE: Heinkel's 'Romeo' was apparently a pulsejet-powered offshoot of the rocket-propelled P.1077 'Julia' programme. via author

Using a pair of 044s was out of the question, however, since the little He 162 fuselage was simply not big enough to hold all the fuel they would need for a reasonable flight time.

The report states: "We are suggesting the installation of one As 044 tube, owing to the increased thrust which has meanwhile been developed.

"The arrangement with one tube gives a considerably better rear field of view than with two tubes. For the installation of two strong As 044 tubes, allowing for at least 20 minutes duration of full-out flight at ground level, the body of the He 162 is too small (approximately 2.2 tons of fuel are required).

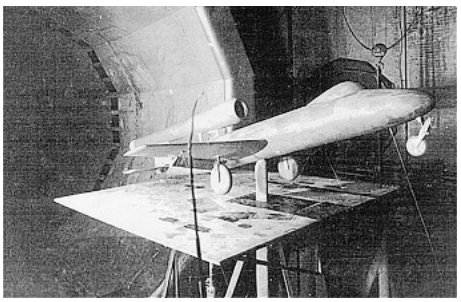
"As a result of the pronounced falling-off in the power unit's thrust with altitude (more than with air density) the maximum speed is attained at ground level. For the same reason flight performance is poor at greater altitudes, so that operational flight can only be considered at low altitudes.

"Take-off must be effected by having recourse to auxiliary starting aid. If the take-off position is not to be betrayed by the smoke of the starting rockets it will be necessary to employ a catapulting device.

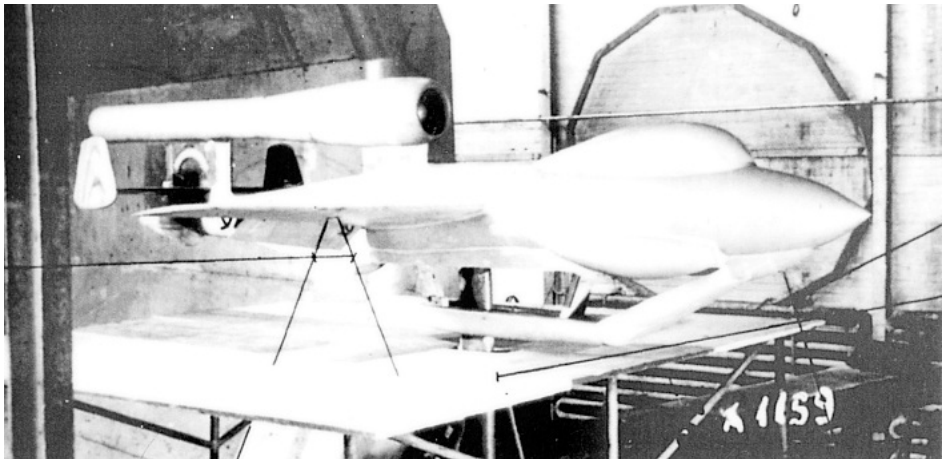
"The amount of fuel required for sufficient duration may be completely disposed of in fuselage and wing making external tanks superfluous. The supply of auxiliary power for the radio unit, fuel and hydraulic systems is provided by a generating set on board the aircraft."

With the Me 328 abandoned, the oddball P.213 presumably rejected without too much debate, 'Romeo' being only a design study and the He 162 development being drafted just as the war was drawing to a close, the Junkers EF.126 appears to have been the most likely prospect for a true pulse jet fighter in service with the Luftwaffe. Even then, development permission was only granted for the EF.126 as an experimental aircraft.

The Russians are believed to have produced the EF.126 using captured German documents and personnel after the war but little is known for certain about this work. ●



ABOVE: During its early development, the EF.126 was tested as a wind tunnel model with a conventional tricycle undercarriage. via author



ABOVE: A later wind tunnel model of the EF.126, now with pointed nose, vertical control surfaces on its tail and sectioned landing skid. via author

Enter the ramjet

Sänger's Lorinantrieb für Strahljäger

Rocket pioneer and aerodynamicist Eugen Sänger started work on ramjets in 1942, the same year that Austrian engineer Otto Kauba was establishing a new company in Vienna to build a flying bomb. In 1943 the two would join forces to work on a highly unconventional fighter design.

Much like his contemporaries and sometime rivals Wernher von Braun and Alexander Lippisch, Eugen Sänger was fascinated by new forms of propulsion.

He had been writing scientific articles and papers about rockets since the early 1930s and towards the end of the decade he and his assistant Irene Bredt began work on a highly ambitious sub-orbital rocket bomber project which attracted the attention and funding of the RLM.

He was appointed to work for the Deutsche Forschungsanstalt für Segelflug (DFS) at Ainring in Upper Bavaria but in 1942 his bomber project was cancelled. Next he began to work on ramjets – engines where air enters an intake at high speed and is slowed, compressed and then combusted to generate thrust.

Within a year he had come up with a proposal for a ramjet engine to power fighter aircraft, which he outlined in DFS report no. 3509, Über einen Lorinantrieb für Strahljäger. This detailed the huge thrust ramjets could produce and the speed benefits for fighters powered by such an engine.

However, he wrote, "present aeroplane structures in combination with large jet tubes cannot be accelerated to the required terminal velocity of 300m per second for strength reasons". In other words, no existing aircraft would be able to cope with the sheer speed produced by a ramjet engine.

Therefore: "This testing can be accomplished with a jet unit mounted in a special structure. This experimental machine can then be towed to a few thousand metres height where it receives the required flying speed by diving in order to put the jet unit in operation with sufficient thrust."

The big problem with ramjet engines is that they only produce a significant amount of thrust when they are already moving at high speed.

Sänger concluded: "In this experimental phase thrust and propulsive efficiency at the desired speeds can be obtained by pressure movements. At the same time the most immediately interesting performances, such as maximum speed, rate of climb, and, if a pressure-tight cabin is used, the ceiling, can be determined. This project is under way."

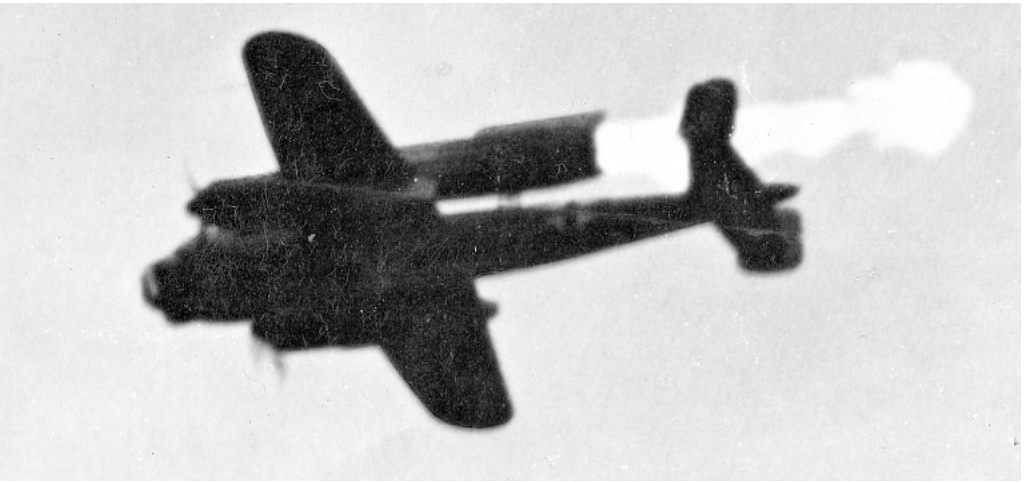
This last remark alludes to a new arrangement between Sänger and the director of a small company with a big name that specialised in designing and constructing experimental aircraft: Otto Kauba of Skoda-Kauba.

In 1942, Kauba had convinced Hermann Göring to fund the development of a highly novel flying bomb – the stubby SK V-1 in Prague – and to require industrial giant Avia, a Skoda-owned company, to build it.

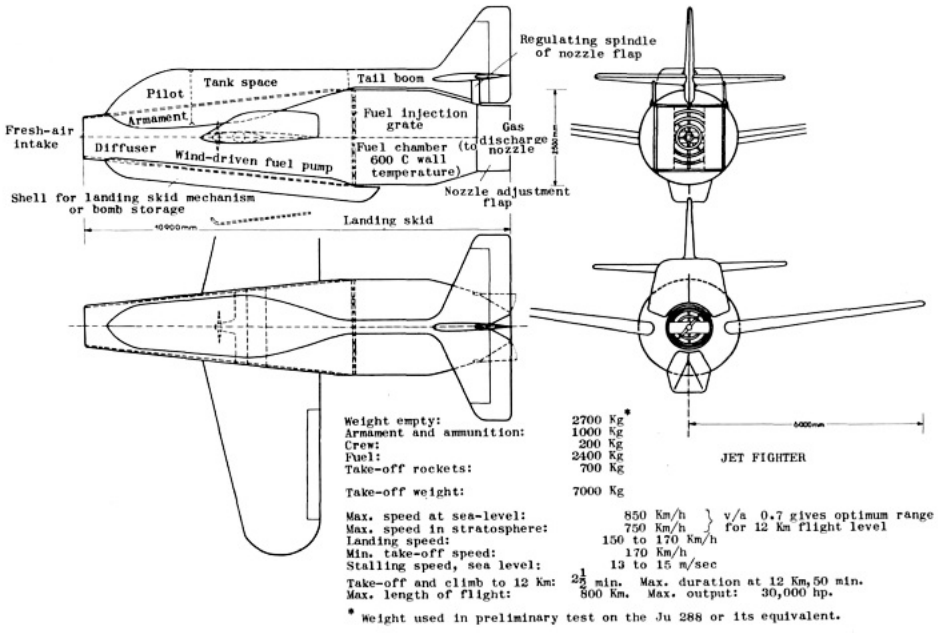
This project had resulted in a handful of prototypes and other work which had been largely unsuccessful but it had enabled Kauba to hire a workforce of 80 Czech and 40 German designers, engineers and craftsmen. This highly skilled team would be ideal for building a working aircraft based on Sänger's fighter concept.

Regarding the use of his fighter at low altitude, Sänger wrote: "The most promising range of application for the high-temperature jet tubes is their use as short-period propulsion units of aeroplanes." He included a drawing of such an aircraft, then described it: "The jet tube of 2500 millimetre maximum diameter forms the fuselage of the jet fighter, with a cabin for the crew and the fuel tank, with tail boom for horizontal and vertical control surfaces set on top, while the landing gear and eventually also the wing structure are attached at the lower side of the fuselage.

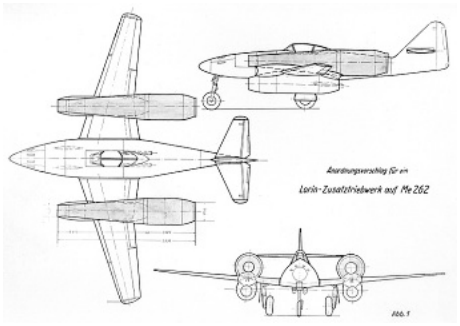
"If landing skids are preferred, the wing structure can be mounted in mid-wing arrangement and continued through the free diffuser space. The double-wall light metal shell design of the diffuser forms the

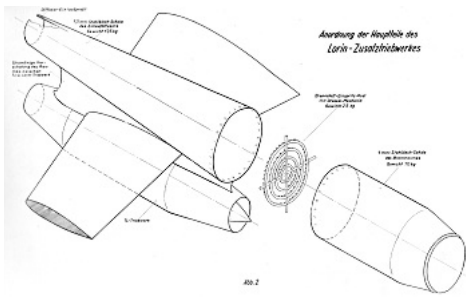


ABOVE AND BELOW: A Dornier Do 217E-2 was used to carry Eugen Sänger's 19,700bhp ramjet for flight tests. These determined that the design produced so much drag that the huge thrust was mostly negated. GDC



ABOVE: During 1943, Sänger worked on how a ramjet-powered fighter aircraft might be designed. The outcome is shown here in a NACA report. The drawings are precise copies of the originals but with English text added in place of German. via author





ABOVE LEFT: Drawing showing how Lorin ramjets might be attached to a ready-built Me 262 to boost its performance – reproduced directly from Sänger's report. GDC
ABOVE RIGHT: Another drawing from Sänger's report showing the design of the ramjets he believed could be fitted to a Me 262. GDC

constructive backbone of the fighter, while combustion chamber and discharge nozzle of the jet tube designed as thin sheet-steel shells because of their high temperature keep distance from the other structural parts."

He said that "the whole aeroplane has no moving parts, but represents a pure shell design, when discounting the few auxiliaries for landing gear operation, cabin air system, fuel injection, nozzle and flap setting and so forth.

"The fuel is to be supplied by a centrifugal pump which, like the other auxiliaries, is actuated by an impeller mounted in half diffuser depth. For take-off two rockets of conventional type at both sides of the fuselage with 1.5 ton thrust each for 30 seconds. The take-off rockets could also be placed within the tube to minimise the eccentricity of its thrust and increase its magnitude at low flying speeds."

In terms of operations, "the fighter can operate over a range of more than 100km at speeds between 720kph and 110kph with a load of 1000kg of bombs or other armament. The potential application is of certain tactical significance against land and sea targets, owing to the penetrating force of missiles dropped at high speed and on account of the element of surprise resulting from the absence of loud aeroplane noises."

As far as high altitude operations were concerned, Sänger stated that his ramjet would not work well above 65,000ft because it need sufficiently 'thick' air to burn, and in any case the length of high altitude operations would be severely curtailed by the amount of fuel that would need to be expended during the initial climb.

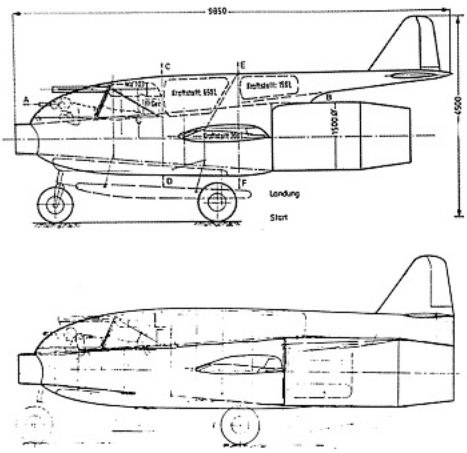
He concludes that it would be better used as a low level fighter or fighter-bomber.

At around the same time, Sänger was carrying out practical tests of working ramjets fixed initially to the backs of lorries and later to the back of Dornier Do 17Z and Do 217E-2 aircraft. In 1944, however, Sänger's experimental work was cut short when fuel rationing began to bite and his allowance was dramatically reduced.

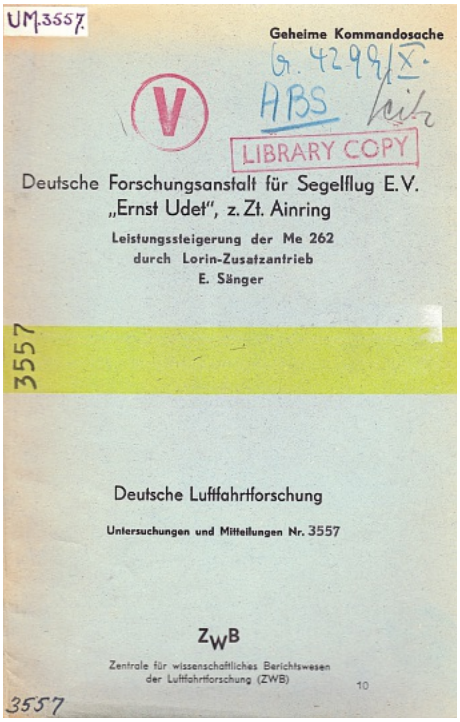
Design work had been progressing at Skoda-Kauba, with detailed drawings produced for a type dubbed the Skoda-Kauba P.14, but now this too was cancelled.

RAMJET-ASSISTED ME 262

At the end of 1944, the RLM asked Sänger to resume his ramjet work but to take it in a different direction. The DFS was, according to Sänger's report of January 31, 1945, given a contract to "draw up designs and performance calculations on a possible increase in performance of the Me 262 with the help of additional Lorin engines".



ABOVE: Two different designs for the Skoda-Kauba P.14. The upper design appears to come from a Skoda-Kauba drawing labelled SK P.14.01. The lower design is from a British intelligence report and can therefore be regarded as a genuine alternative design – although it appears labelled simply 'P.14' so its full name may never be known. via author/TNA



ABOVE: The cover of Sänger's report on adding ramjets to the Me 262. GDC

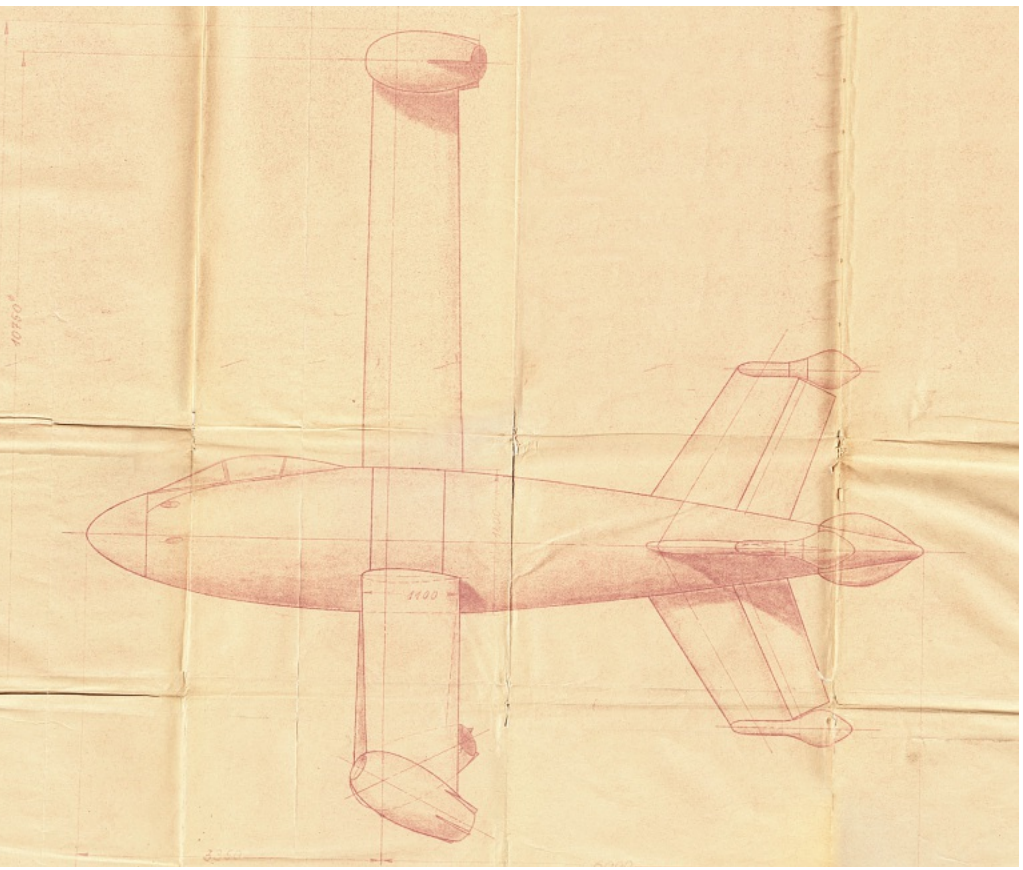
He wrote: "It is our opinion that the Lorin engine is very suitable as an attachment to finished airframes, although these may not be designed to perform well close to the speed of sound.

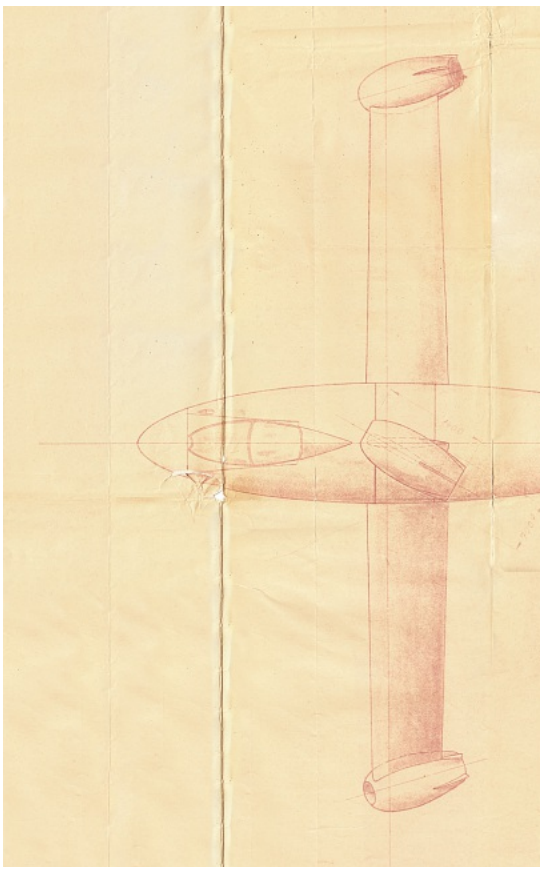
"Nevertheless, the task was undertaken as a compromise solution to giving the Me 262 better climb performance and a higher ceiling with the least possible time and effort."

Sänger states that much of the work detailed in the report – which mostly consists of graphs and calculations – was carried out by Dipl. Math. W. Peterson and Dipl. Ing. W. Lungstras.

The conclusion of the report was that the Me 262 could be made to go faster but at a cost of dramatically increased fuel consumption.

Like the Skoda-Kauba P.14, Sänger's ramjet-assisted Me 262 never left the drawing board. ●





'Entirely novel in conception'

Focke-Wulf ramjet projects

Having already worked on the in-house development of gas turbines, Focke-Wulf became interested in ramjets during the early 1940s. A dedicated team was established to work on the project and they succeeded in coming up with a design entirely unlike anything that had gone before…

The ramjet type powerplant concept predates jet engines by some considerable margin – having been invented and patented by Frenchman René Lorin in 1913.

In the same way that they called the piston engine 'Otto' after the man they saw as its inventor, the Germans called the ramjet Lorin. The British tended to refer to it as the athodyd instead – a contraction of Aero THermoDYnamic Duct.

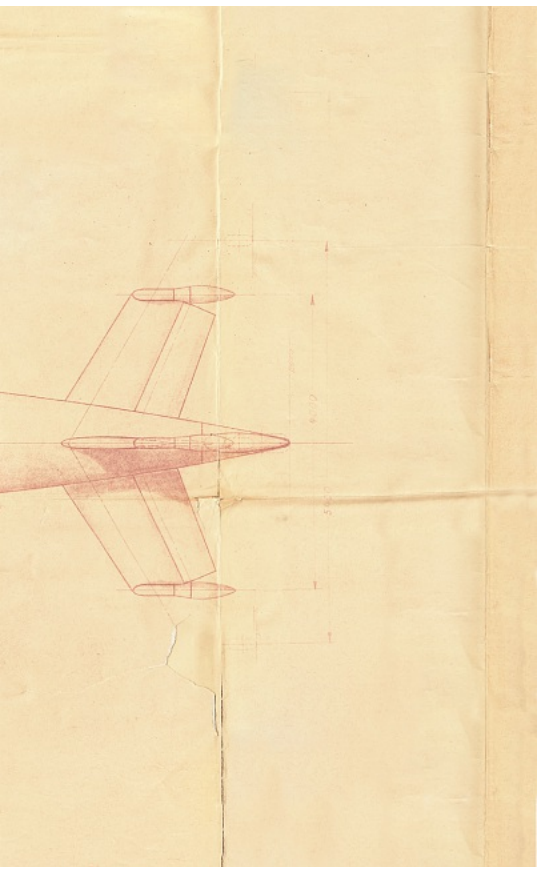
Lorin had failed to create a working ramjet because the necessary materials for its construction had not yet been invented. The design also required the engine to be moving before it could produce thrust – the air being 'rammed' into the front acting like the compressor of a jet engine. Lorin was also unable to get his engines moving fast enough.

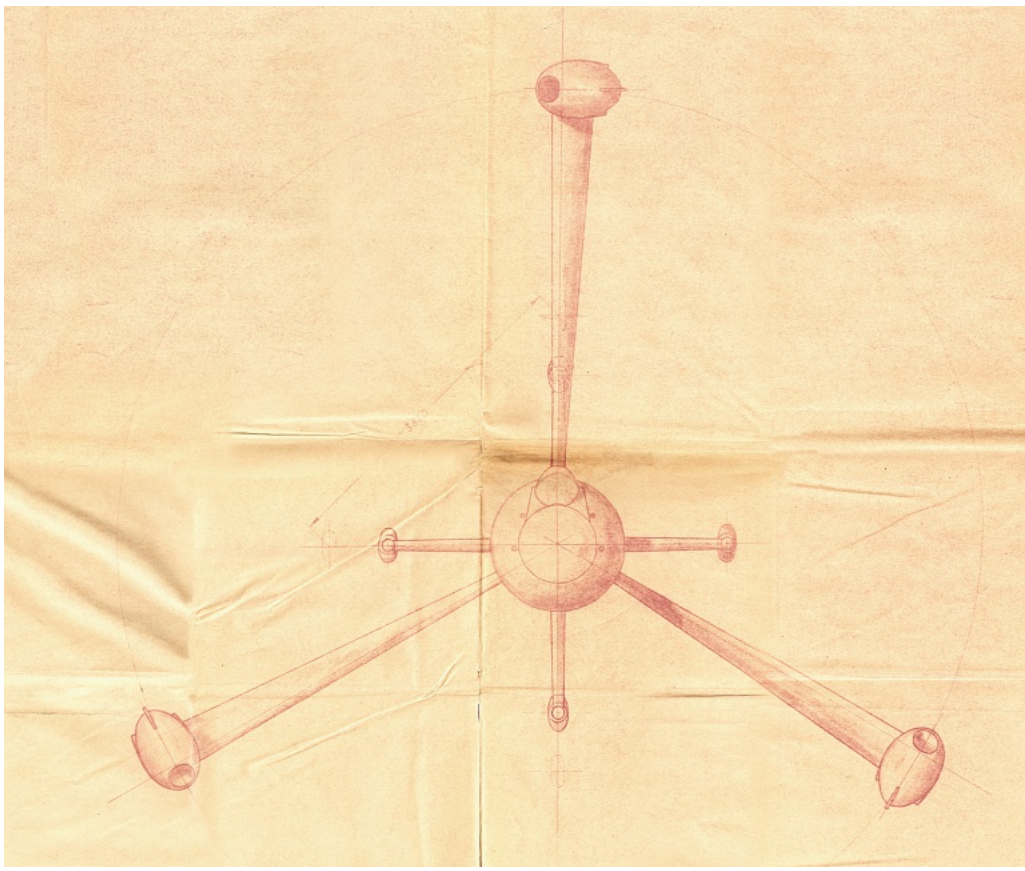
These problems were more easily overcome in Germany during the late 1930s, however, and engineer Hellmuth Walter began working on a ramjet in 1936. Walter realised that if a ramjet could be made to work, it could provide a simple, lightweight means of producing a huge amount of thrust – but success eluded him and he concentrated on rockets instead.

BMW and Junkers also investigated the concept before Eugen Sänger of the German Research Centre for Gliding (DFS) went a step further in 1942 by creating and testing working ramjets – running them on the back of Dornier Do 17s and 217s in flight – with the specific goal of creating an example that could power an interceptor aircraft.

The history of Focke-Wulf's involvement in ramjets is revealed in a US report on the interrogation of company aerodynamicist Dr Otto Ernst Pabst on May 21, 1945: "Pabst stated that his last job was on the ramjet motor. This project originated from a visit of Sänger to [Focke-Wulf chief designer Kurt] Tank. Sänger had built and flown a ramjet motor, but it was no good because it was too long and had high drag and high skin friction.

"In fact the skin friction alone was so high that there was no net thrust. Pabst suggested to Tank that he could do a better job, i.e. get lower drag."





TOP LEFT: Detail of Focke-Wulf drawing number 0310 240-004 'Triebflügeljäger mit L-Antrieb', dated September 30, 1944, showing a side view of the aircraft. MIDDLE: The Triebflügeljäger as viewed from above. Note that the original drawing, of which this is the only known example, is damaged. ABOVE RIGHT: A striking forward view of the Triebflügeljäger. GDC

According to a British report, Pabst stated that he had begun work on ramjets in 1941, Focke-Wulf having already been made aware of the technology, and simply kept a close eye on reports of Sänger's work as it progressed. This latter seems more likely since Focke-Wulf was renowned for keeping close tabs on all developments in propulsion.

Whatever the truth, a research station under Pabst was set up at Kirchhorsten in 1943, near Focke-Wulf's design and research headquarters at Bad Eilsen, and work was begun on combustion problems with the goal of cutting down the length of Sänger's duct.

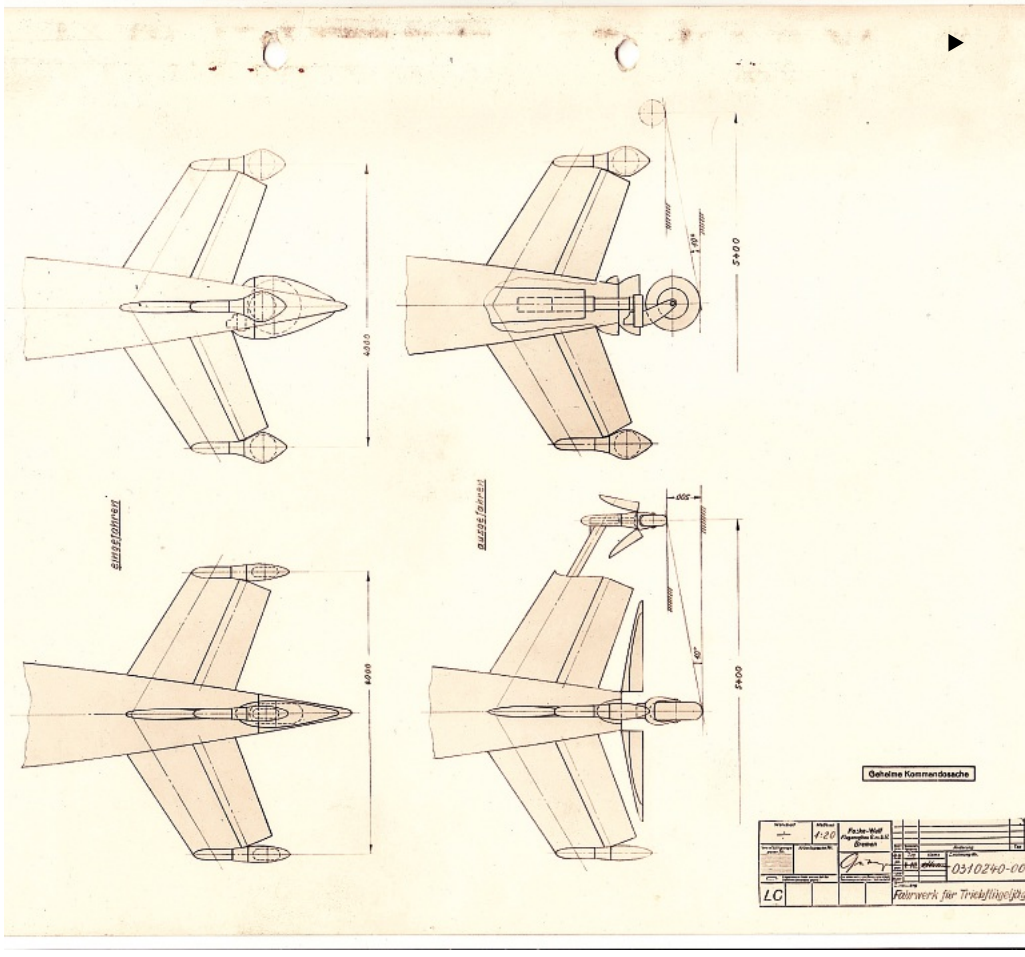
Pabst used hydrogen gas to fuel a conical burner and was apparently making progress, so thoughts turned to how a fighter fitted with his ramjet could be made to move fast enough in the first place for the duct to then start working.

Four possible 'starters' were looked into: a small auxiliary jet propulsion unit, a propeller and engine, an enclosed or shrouded propeller and engine, and a rocket motor.

Apparently the latter was preferred since both of the Focke-Wulf ramjet designs known about in any detail feature rocket starters.

The more conventional of the two, outlined in the company's Baubeschreibung Nr. 283 dated August 4, 1944, and referred to as a Strahlrohrjäger or 'Ray tube fighter', was a single-seater with a very long nose and sharply swept-back wing. The tailplane was swept-back at both leading and trailing-edges and two Pabst ramjet units were mounted, one of either side.

The Walter rocket starter was installed at the end of the fuselage, below the tail. Behind the guns in the nose there was a 20mm armour bulkhead protecting the forward ramjet fuel tank of 308 gallons capacity.



ABOVE: Another drawing from the sequence, 0310 240-005 'Fahrwerk für Triebflügeljäger, dated October 4, 1944, shows how the type's landing gear was intended to function. The tail-tip fairings popped open to reveal the wheels. GDC

The cockpit was in the middle and behind it were three more tanks – another one for ramjet fuel and the other two for the rocket motor's hydrazine hydrate and hydrogen peroxide.

Regarding the wings, the report states: "The strongly swept back wing has two spars and is provided with detachment places at the fuselage sides.

"The two spars, passing through the fuselage, are solidly joined to it. For aerodynamic reasons, there are no flaps, ports or other disturbing parts on the wing for 60% of the chord. A perfect smoothness in the most vulnerable region of the wing is thereby achieved."

And as for the landing gear: "The relatively large wheel base makes for an especially light nose wheel. The nose wheel is swung backwards into the fuselage by means of a hydraulic strut. The main landing gear is a rocking lever landing gear.

"The disadvantages of the small width of the track, limited by the fuselage width, are compensated by the low position of the centre of gravity and the rigid connection of the two rocking levers. A centrally located oleo-pneumatic strut is the shock absorber."

In this design, each ramjet was 8.8ft long and 4.4ft in diameter, providing 10,850hp of thrust and sea level and 2270hp at 36,000ft. By comparison, the Fw 190's BMW 801D-2 engine produced around 1677hp.

During take-off, it was projected that the Walter rocket engine would give 6600lb thrust for a period of 33 seconds – this still leaving enough fuel for an extra boost in an emergency, such as having to make another circuit of the airfield during landing.

Baubeschreibung Nr. 283 also details Focke-Wulf's views on the usefulness of ramjets as a powerplant for fighters: "The ramjet fighter is a particularly fast aeroplane, with a high ceiling and good climbing power. The use of such fighters calls without doubt for new tactics, which must be developed accordingly

"Their high rate of climb and horizontal speed allow their use against bombers with 435mph average speed, which fighters with Otto engines cannot fight successfully.

"Their speed superiority of about 310.7mph compared with the normal bomber formations makes pursuit possible to a greater distance than with Otto engine fighters. In combat itself, an approach directly from behind is often the most favourable, for it offers the longest time of fire.

"There is possibility for the installation of two MK 103s, four MK 108s or four MG 213s. Considering the short duration of attack, density of fire must be preferred to an extended flight path with possible greater range, so that the installation of four machine guns (MG 213s) appears to answer the purpose best.

"Nor must it be forgotten that a synchronising of the speed of the ramjet-propelled fighters with the bomber speed can hardly be possible, because of the limited controllability of their engines."

The other Focke-Wulf ramjet design about which most is known is referred to as the Triebflugel Flugzeug or 'Power-wing Aircraft'. There was great excitement among the Allies when they captured drawings and papers relating to it and the author of German Aircraft: New and Projected Types, featuring 174 unusual types, wrote in his introduction: "...among the rotating-wing aircraft is a fighter entirely novel in conception".

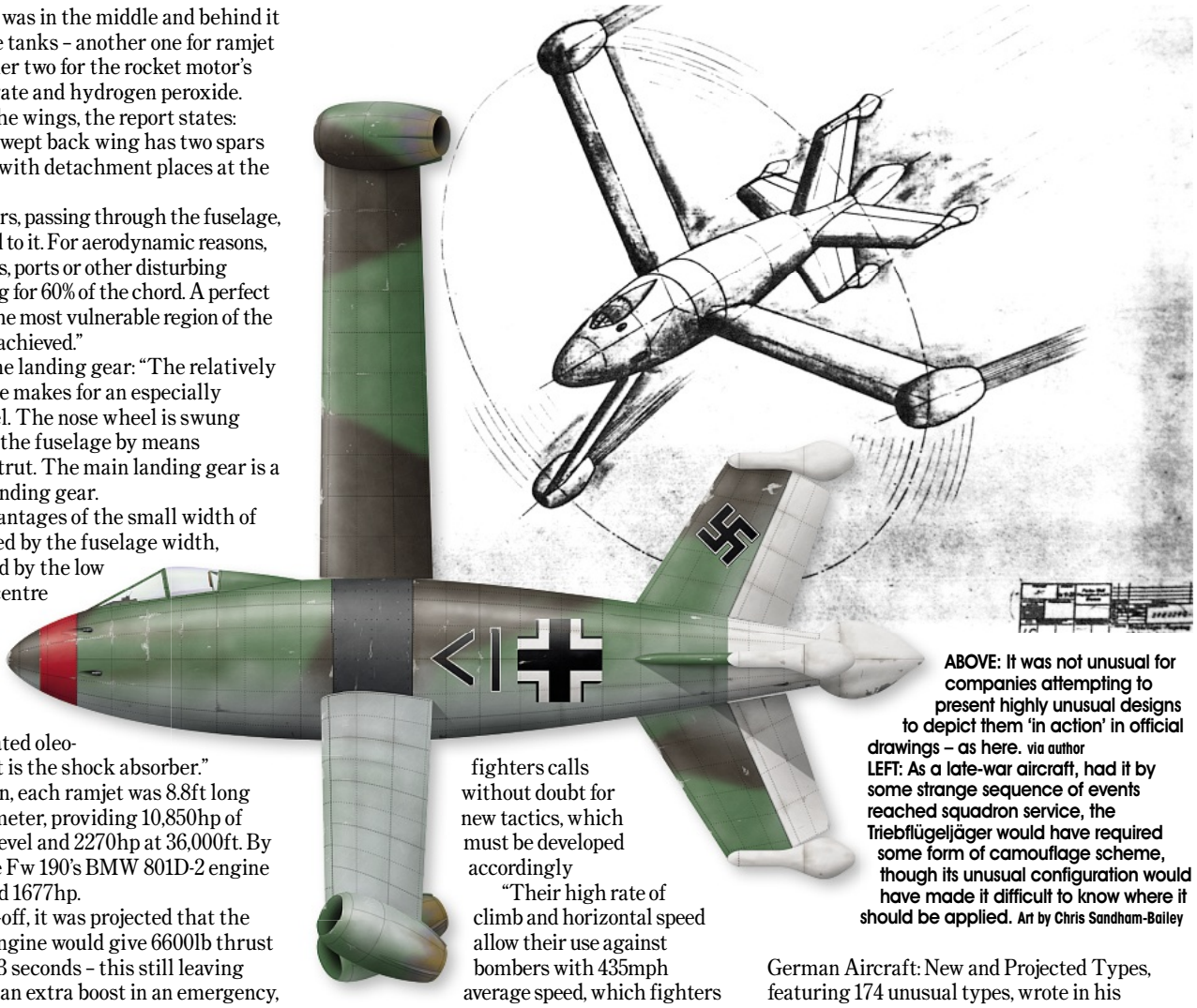
Another Allied report on Focke-Wulf ramjet developments stated: "Information gained by questioning Dr Pabst: Discussion of this power unit revealed that this development of the power unit and rotating wing aircraft was considered to be of utmost importance, and was so considered because the material for the power unit was no more than low carbon steel.

"Further, a very low grade of fuel could be used, and, due to the scarcity of gasoline, this fact became of great importance."

The Triebflugel Flugzeug had three rotating wings, each with a ramjet at the tip. The pitch of the wings could be adjusted by the pilot and their maximum speed, which was to normally be used only while climbing, was 670ft/sec (455mph).

Having the ramjets spinning from the outset meant they could be activated while the aircraft fuselage itself was still sitting motionless on the ground.

For take-off the aircraft was to stand on its tail, which housed five wheels. Three small 660lb thrust Walter rocket engines, each incorporated

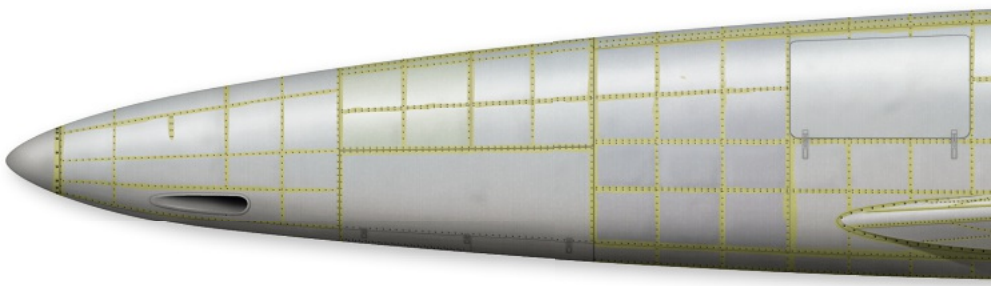


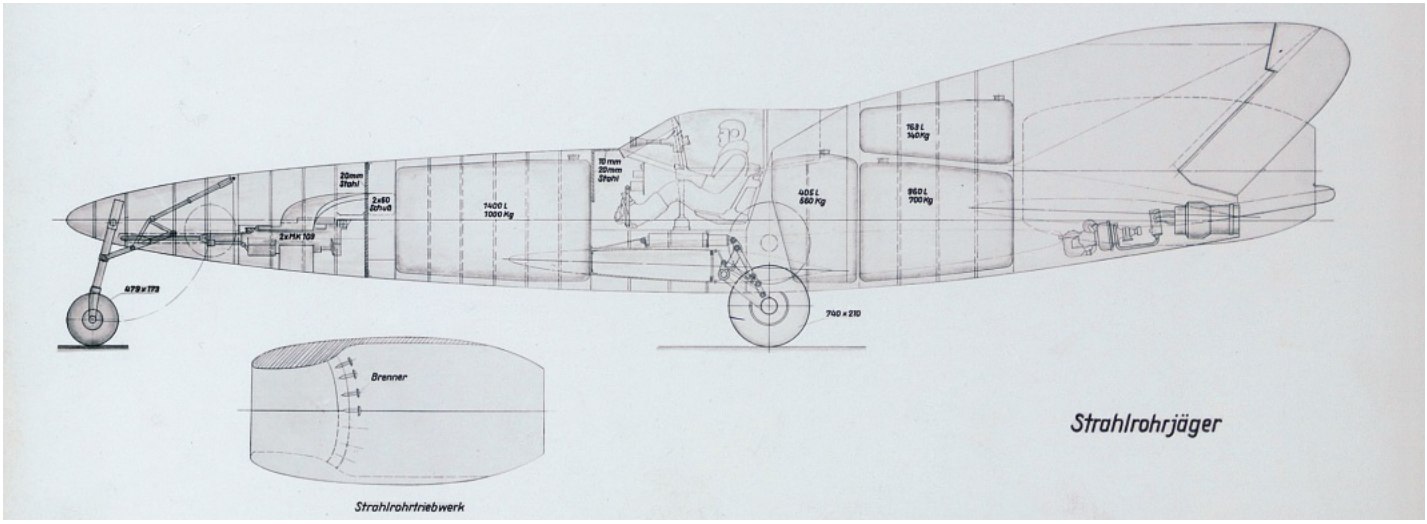
ABOVE: It was not unusual for companies attempting to present highly unusual designs to depict them 'in action' in official drawings – as here. via author
LEFT: As a late-war aircraft, had it by some strange sequence of events reached squadron service, the Triebflügeljäger would have required some form of camouflage scheme, though its unusual configuration would have made it difficult to know where it should be applied. Art by Chris Sandham-Bailey

RIGHT: It was not unusual for companies attempting to present highly unusual designs to depict them 'in action' in official drawings – as here. via author

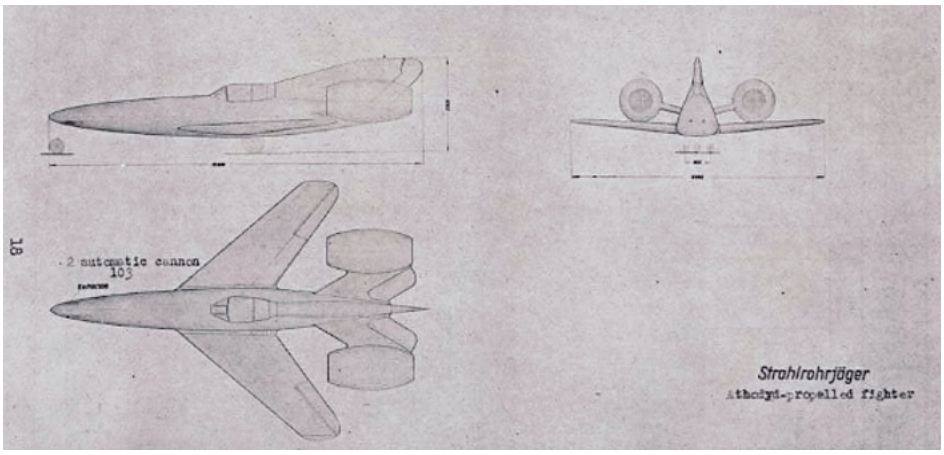
FOCKE-WULF TRIEBFLÜGEL FLUGZEUG SPECIFICATION

Diameter (wingspan):	**35.4ft**
Length:	**30ft**
Max speed at sea level:	**620mph**
Max speed at 46,000ft:	**520mph**
Rate of climb at sea level:	**24,600ft/min**
Rate of climb at 49,000ft:	**400ft/min**
Climb to 3280ft:	**8.2 seconds**
Climb to 49,000ft:	**11.5 minutes**
Range at sea level:	**400 miles**
Range at 46,000ft:	**1500 miles**
Endurance at sea level:	**42 minutes.**
Endurance at 46,000ft:	**3 hours 24 minutes**
Armament:	**2 x MK 103 (100 rounds each), 2 MG 151 (250 rounds each)**





ABOVE: A side view of the Focke-Wulf Strahlrohrjäger, showing its extremely low undercarriage, rocket engine and armament. The ramjet is inset. TNA



ABOVE: Three-view of Focke-Wulf's other verifiable ramjet fighter, the Strahlrohrjäger. TNA

into one the ramjets, would be used to get the wings rotating and the ramjets started.

The wings would be at neutral pitch to begin with, then moved into fine pitch, creating lift. Once the aircraft reached the desired altitude and began to level out, the pitch would be increased and the speed of wing rotation therefore reduced to prevent the wing tips from exceeding Mach 0.9. At the aircraft's top speed in forward motion, the wings would be rotating at 220rpm.

The Focke-Wulf report on the Triebflugel Flugzeug stated that the design had six key benefits: low fuel consumption, high altitude capability, no runway needed, low weight, simplicity and the ability to use any combustible gas or liquid that could be vapourised as fuel.

These benefits are identically noted in both British and American reports on the design but the US report, Technical Intelligence Report A-396, dated June 5, 1945, also states: "There has been some discussion about the use of pulverised coal. However, this brings up the difficulties of fuel metering."

It also goes into more detail on the landing procedure: "Landing is accomplished by 'backing' the aircraft into the ground. The five wheels are enclosed in the projections on the tail surfaces and the rear core of the fuselage.

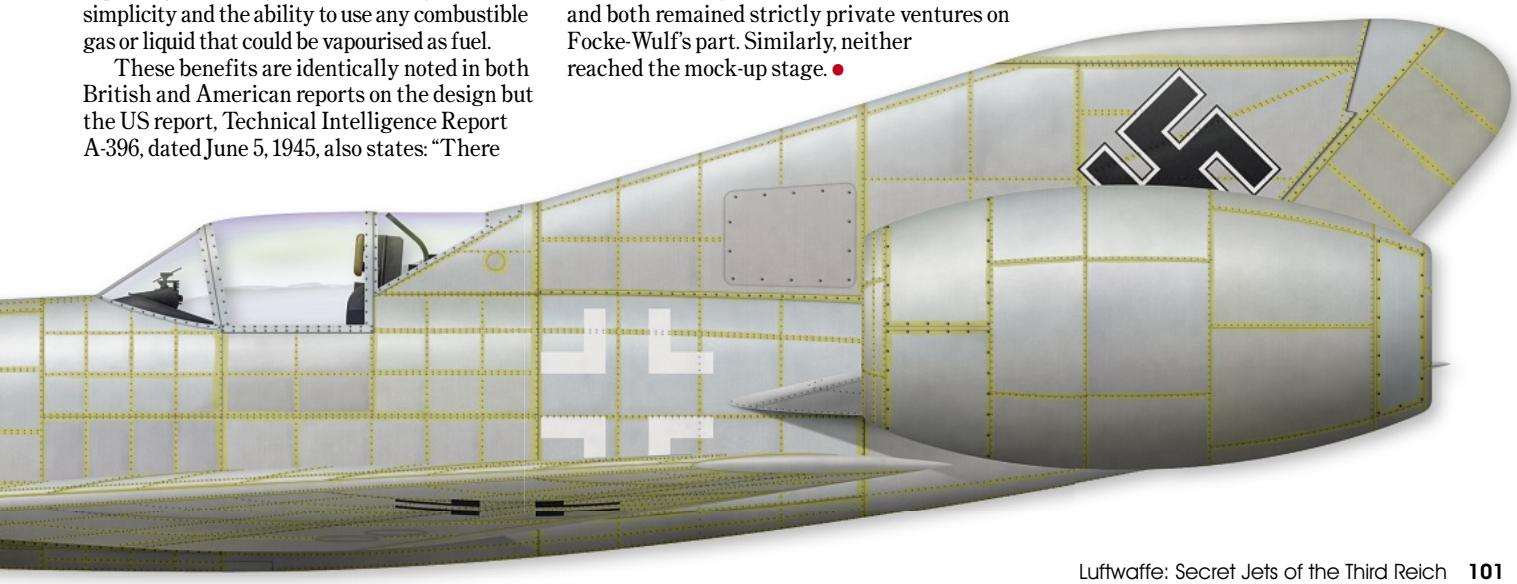
"Mention was also made of a catching device, but no other details were discussed. It is presumed that such a catching device would be similar to those employed on naval rigid lighter than air craft for picking up heavier than air craft."

Neither design was submitted to the RLM and both remained strictly private ventures on Focke-Wulf's part. Similarly, neither reached the mock-up stage. ●

FOCKE-WULF STRAHLROHRJÄGER SPECIFICATION

Wingspan:	**26.2ft**
Length:	**38.9ft**
Wing area:	**204sq ft**
All-up weight (with 5500lb of fuel):	**11,880lb**
Starting run:	**550 yards**
Time from standing start to beginning of steep climb at 3000ft:	**2 minutes**
Time of climb from 3000ft to 36,000ft:	**2 minutes 18 seconds**
Rate of climb at 3000ft:	**31,500ft/min**
Max speed at sea level:	**682mph**
Max speed at 36,000ft:	**592mph**
Range at sea level:	**143 miles**
Range at 36,000ft:	**435 miles**
Endurance at sea level:	**13 minutes**
Endurance at 36,000ft:	**43 minutes**
Armament:	**2 x MK 103**

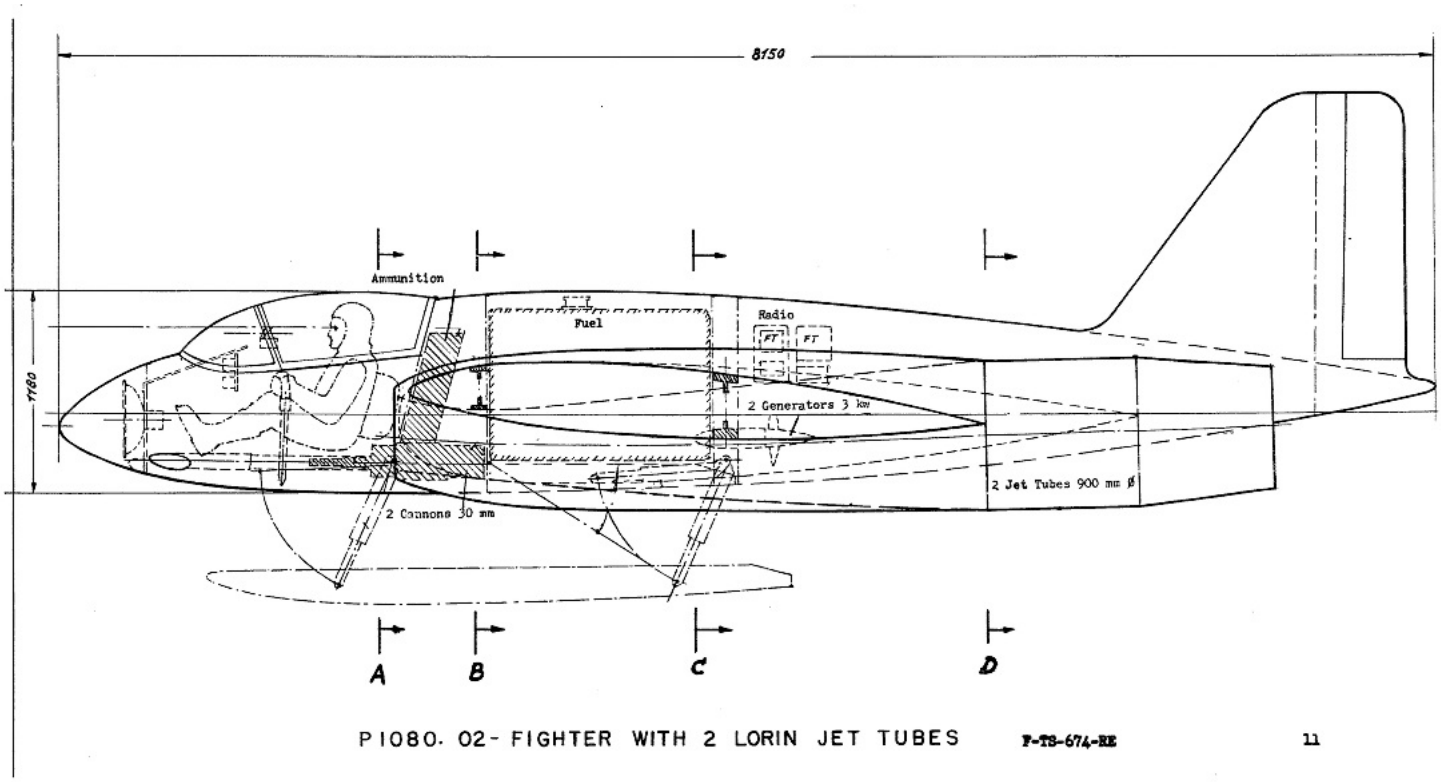
BELOW: At the end of the war, the last Me 262s built had no paint applied – either through lack of time or lack of paint. Perhaps Strahlrohrjäger aircraft, had they been built, would have suffered a similar fate. Art by Chris Sandham-Bailey



Last gasp Heink

P.1080 single seat fighter with Lorin jets

As the Allies entered Germany and began driving towards Berlin, the RLM decided that there was real potential in ramjet engines. With the He 162 being prepared for front line service, Heinkel now had some spare design capacity so it was sent the results of Dr Eugen Sänger's ramjet experiments and told to design a fighter with them…



ABOVE: Almost certainly the last Heinkel project of the Second World War – the tiny P.1080 ramjet-powered fighter, pictured in profile. GDC

There was no experience of working with ramjets at Heinkel but its design staff at Vienna did have a lot of recent experience in advanced aerodynamics and in using low grade materials thanks to the He 162 project.

In early 1945 the RLM decided to take advantage of this resource and asked the company to design a ramjet-powered fighter using the test results and designs produced by Dr Sänger over a year earlier.

The result was to be Heinkel's final entirely new project of the Second World War, though not its final design.

Within days of the first drawings, however, on March 31 the Heinkel designers were forced to pack up and rapidly relocate ahead of the advancing Soviet army. Much of what could not easily be carried was burned – destroying details and drawings of many Heinkel advanced projects.

This effectively spelled the end of the company's wartime design effort – until many of the staff were captured by the Americans, who ordered them to produce reports and new drawings of all their most recent work.

It was chief designer Siegfried Günter who wrote the report on the P.1080, T-2 report number F-TS-674-RE, the only surviving evidence of the project.

In it, Günter writes: "Shortly before the end of the war the project design office of the Heinkel firm received data concerning the Lorin jet developed by Dr Sänger from the RLM. The RLM ordered the design of a single seat fighter with this powerplant.

"Of course, aeroplanes powered by the Lorin jet can only take off by means of additional propulsion assistance. It is economic to accelerate as rapidly as possible up to the speed of best rate of climb and to provide ample powder rockets for that.

"There is almost no thrust near the landing speed. Therefore taxying after landing is impossible unless wheels are provided which are driven by electric motors. This complexity and its accompanying problems are too great for a single seat fighter. Thus, landing on skids is provided, with take-off on a detachable undercarriage or even better on a take-off car.

"For the Lorin aeroplanes, there were to be provided rockets with a total weight of 500kg (thrust of 4 x 1000kg, 12 seconds) fastened to a take-off car which are burned during the ground run; an identical set of rockets fastened to the aeroplane are ignited in sequence upon leaving the ground."

Günter then gives a detailed comparison between the projected performance of a tailless aircraft design powered by the HeS 011 turbojet, specifically the P.1078B, with the anticipated performance of the

el ramjet

ramjet powered P.1080, concluding: "The comparison shows that aeroplanes with Lorin-jet propulsion are eminently suited for flying in the stratosphere. However, it must be kept in mind that the data of the Lorin-jet has not yet been sufficiently tested.

"Remarks regarding the design: There are two important advantages of the design fitted with two Lorin-tubes as compared to the design with one tube. First, the favourable installation of the cockpit and the better vision. Secondly, two small tubes result in smaller unstable moments about the normal axis.

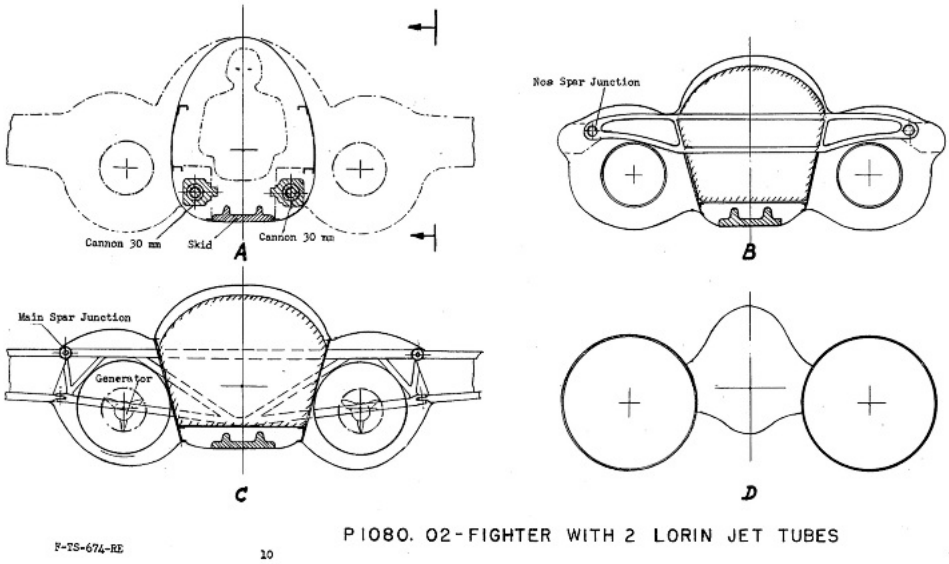
"The tubes are placed at the most aft possible position in order to keep the hot part of the tube free of structure details and cowling, and to get effective cooling. A Lorin-jet powered aeroplane is not able to accelerate again in the case that the landing cannot be completed (because of landing errors or emergency). Thus, decreased landing speed is urgently necessary.

"Power required for pumps, compressor, armament and radio is furnished by two generators installed inside the Lorin-tubes. The considerable decrease of air speed in the diffuser of the Lorin-jet improves the efficiency of this device.

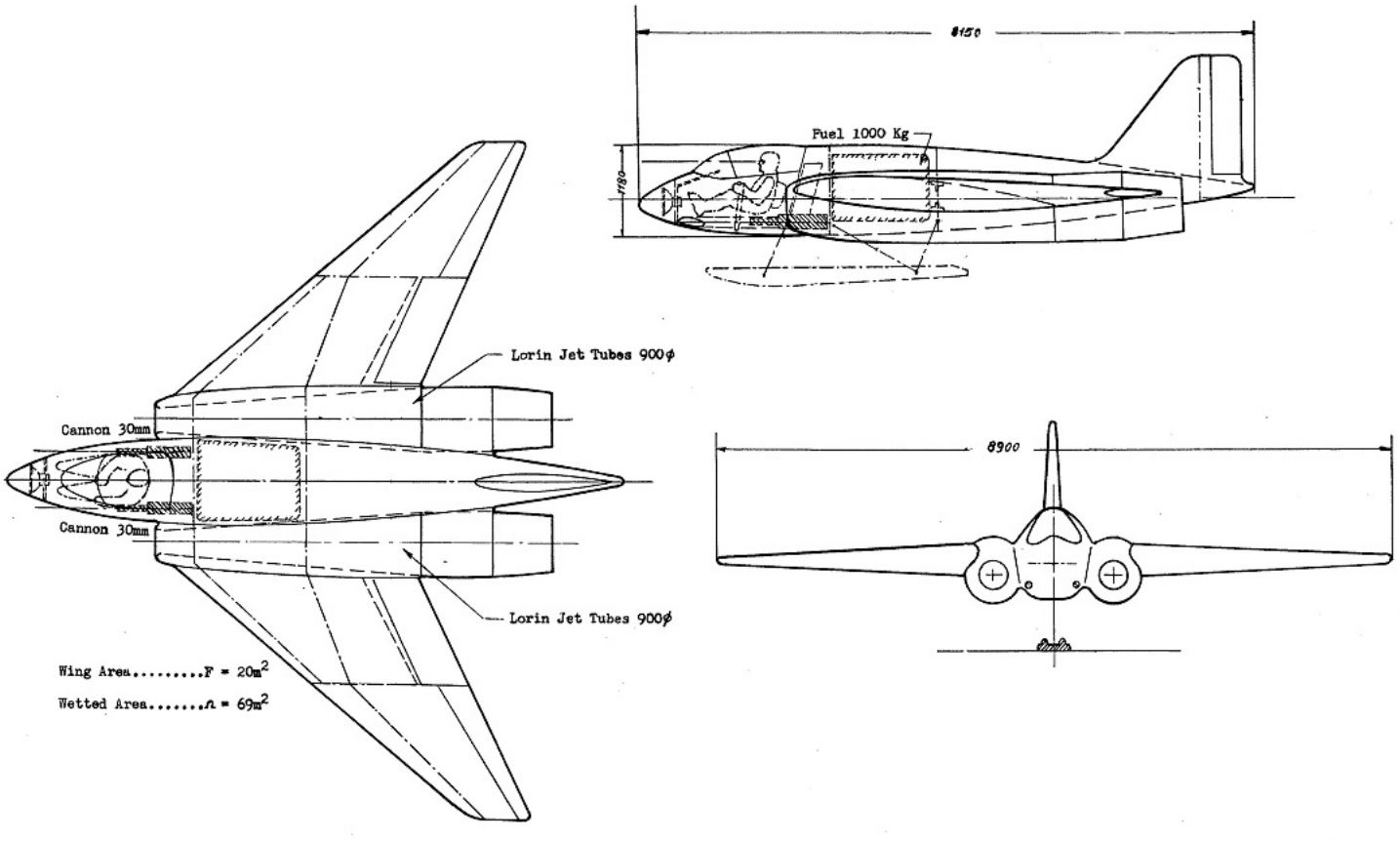
"When starting, the skid is retracted. The springs of the retracted skid legs are compressed. It is then possible to extend the skid without additional power."

No mention is made of armament, but the drawings provided show the P.1080 fitted with a pair of 30mm cannon.

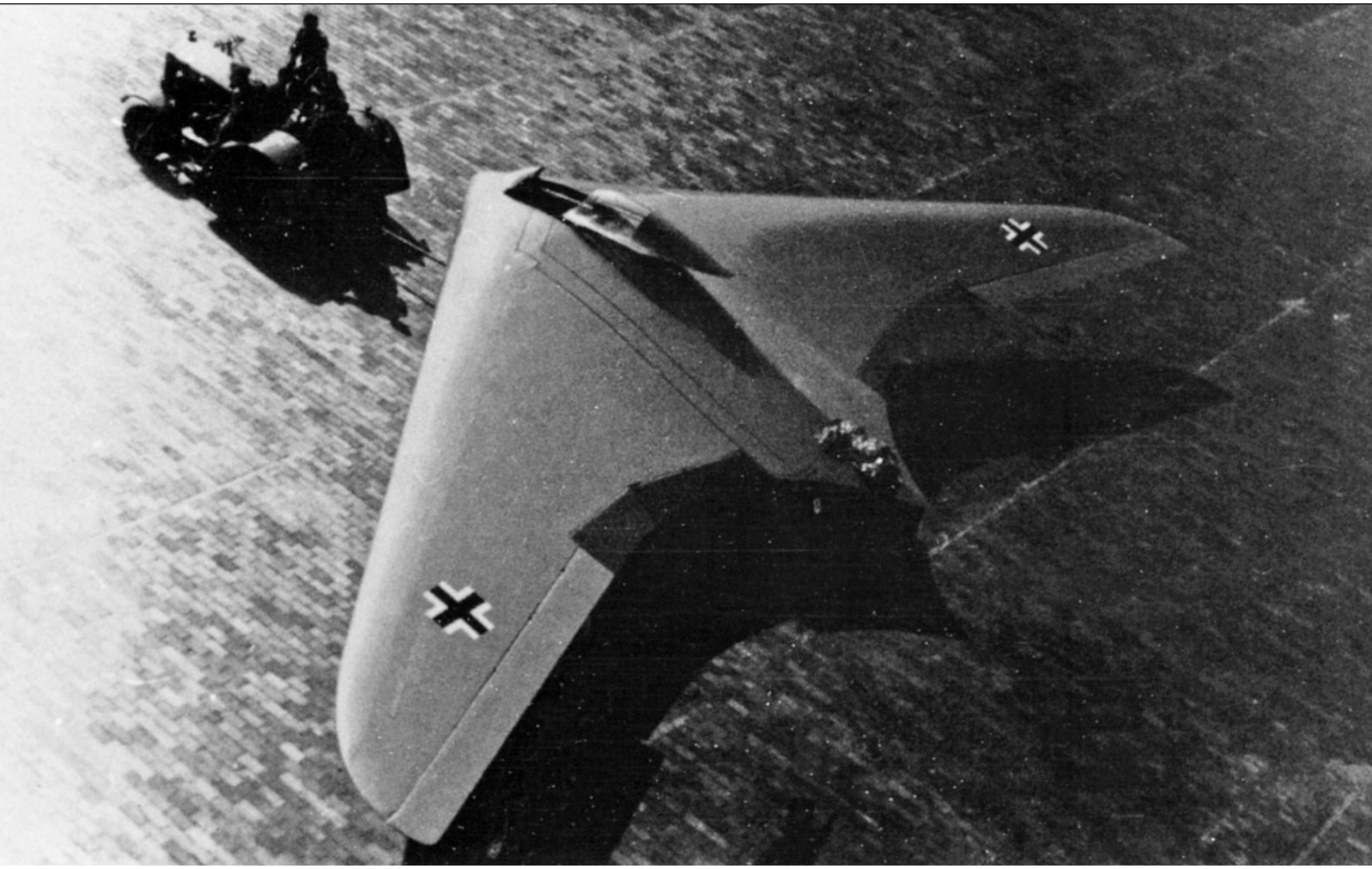
Günter's report, completed in German, was then translated into English and reissued on July 15, 1946. Despite his work for the Americans, Günter ended up working as a designer for the Soviets from 1946 to 1954. ●



ABOVE: Cut-through sections highlight the structural spars, generators, armament and landing skid of the P.1080. GDC



ABOVE: A three-view drawing of the Heinkel P.1080. It is clear from the accompanying report drafted after the war by Heinkel staff that the project was unfinished. The drawings do not illustrate where the four take-off rockets described would be attached, nor how the aircraft would have sat upon its rocket-propelled take-off trolley. GDC



Wildcard

Horten 8-229

A tailless flying wing powered by twin turbojets, the Horten brothers' 8-229, or Horten IX, was one of the most radical designs considered for series production during the course of the war. Like Eric Bachem's Natter, despite every setback it came closer to fruition than most.

Charismatic brothers Walter and Reimar Horten had become interested in gliders just as the golden age of unpowered flight was reaching its peak in Germany.

Aged 12 and 14 respectively, they began to regularly attend gliding events on the Wasserkuppe in 1927 and inspired by Alexander Lippisch's cutting edge flying wing designs, they produced their first glider in 1933, the tailless H I. Over the next three years, they refined their designs and regularly attended flying events.

When Reimar was called up for military service in 1936 he had the good fortune of being assigned to JG 134. His new commanding officer, Hauptmann Oskar Dinort, a competitive glider pilot, already knew him and couldn't believe his luck at having his own glider designer on staff.

He made Reimar a reserve officer and had him put through basic training before giving him a position as an instructor. Then he asked Reimar to build him three H II gliders that he could use during the next major competition on the Wasserkuppe in 1937.

Excused regular Luftwaffe duties, Reimar was given workshop facilities, materials and even skilled engineers and craftsmen to carry out the work. Walter, meanwhile, was training as a Luftwaffe pilot. Whenever they had time the pair worked together on a twin engine pusher flying wing design, the H V, sponsored by chemical company Dynamit AG which was interested because the design called for plastic panelling to be used.

While this plastic flying wing project failed when the first prototype crashed, it brought the brothers to the attention of the RLM for the first time.

The first pair of H IIs were completed in time for the 1937 contest but neither performed well, being too nose-heavy. Dinort left JG 134 in March 1937 and Reimar's new commander did not take kindly to having him spending all his time building gliders – but Dinort then personally recommended the brothers' work to Ernst Udet, the head of the RLM's technical department.

Thanks to his patronage, despite their other Luftwaffe duties, the brothers were allowed time to work on their next project, the H III, which was an enlarged H II. This secured an order for 10 examples under the RLM type designation 8-250, famous female test pilot Hanna Reitsch flew an H II in November 1938 at Udet's behest and the brothers won the Lilienthal Prize for their outstanding contribution to aircraft design.

When Lippisch went to work with Messerschmitt in 1939, Udet tried to set up a similar arrangement between the Hortens and Heinkel where Reimar would work on the H VII, a fighter version of the H V. This came to nothing however, because Heinkel wanted to retain the patents on the brothers' work and they refused.

With the outbreak of war, Walter became the technical officer of Adolf Galland's unit, I./JG 26. During the Battle of Britain, he flew a Messerschmitt Bf 109E on 45 missions before technical officers were forbidden from active involvement in combat missions in September 1940.

Throughout the early years of the war, the brothers continued to work on their

LEFT: The Horten IX V1 flying wing glider under tow after a test flight – its brake parachute is bundled up on the rear section. via author

flying wing designs and in May 1941, Walter was made responsible for inspecting the operational status of fighter units, eventually directly under the general of fighters – first Werner Mölders and then Adolf Galland. This influential position enabled him to learn about top secret aircraft developments within the RLM.

The brothers persuaded Udet to let them develop the H V as a single seat fighter in October 1941 and they were given the resources to repair the crash-damaged prototype which had been languishing out in the open for nearly four years.

A special Luftwaffe unit was actually set up to oversee this work – Sonderkommando LIn 3, under Reimar's command. Udet died the following month but by now this unit was a fully functioning enterprise. By the autumn of 1942 it was employing 30 Luftwaffe personnel and Walter took over its command, using his connections to draw in still more personnel and keep Reimar up to date with the latest developments in jet technology.

Through this series of unlikely events, the Hortens had established their own little autonomous kingdom within the Luftwaffe which enabled them to pursue their ambitious plans to build flying wings. The H VII was given the RLM type number 8-254 and Sonderkommando LIn 3 began building it. Walter was in a relationship with Udet's former chief secretary, Fräulein von der Groeben, who was able to process the unit's telegrams through official channels without arousing suspicion.

The H VII was cancelled in March 1943 and Sonderkommando LIn 3 was largely disbanded but by now the brothers had a new project in mind which would be jet-powered: the H IX.

THE IMPLACABLE H IX

The H IX was to be a single seat twin-jet fighter from the outset, but the brothers decided that it might also be capable of meeting a requirement personally issued by Reichsmarschall Hermann Göring for a bomber that could carry a 1000kg payload for a distance of 1000km, reaching speeds of 1000kph.

They drafted a 20 page proposal which was circulated around the RLM for several months and in the meantime picked up an order for three H IV gliders under the RLM type number 8-251. Eventually, having become aware of work on flying wings being carried out in America by Jack Northrop, Göring invited the brothers to pitch their H IX idea to him directly on September 28, 1943.

Although the type wasn't capable of meeting the 1000 x 1000 x 1000 requirement in full, it was close enough for Göring to give the brothers a 500,000 Reichsmark development contract on condition that the first prototype was flying on March 1, 1944. With this cash in hand they filed the paperwork for new firm Horten Flugzeugbau GmbH in their hometown of Bonn, but then renamed and reconstituted their pet Luftwaffe unit, as Luftwaffen-Kommando IX, and re-established it at Göttingen – now with a staff of 200 – to get the first H IX prototypes built.

However, Udet's replacement Erhard Milch was concerned that the H IX was too complex to be produced within the given timeframe, particularly by small-time glider builders like the Horten brothers. He felt that other developments, particularly those that had already undergone extensive development such as the Ar 234 and Me 262, were more promising.

The H IX was given low priority status – making it more difficult for the brothers to acquire materials and resources such as engines and fuel to run them.

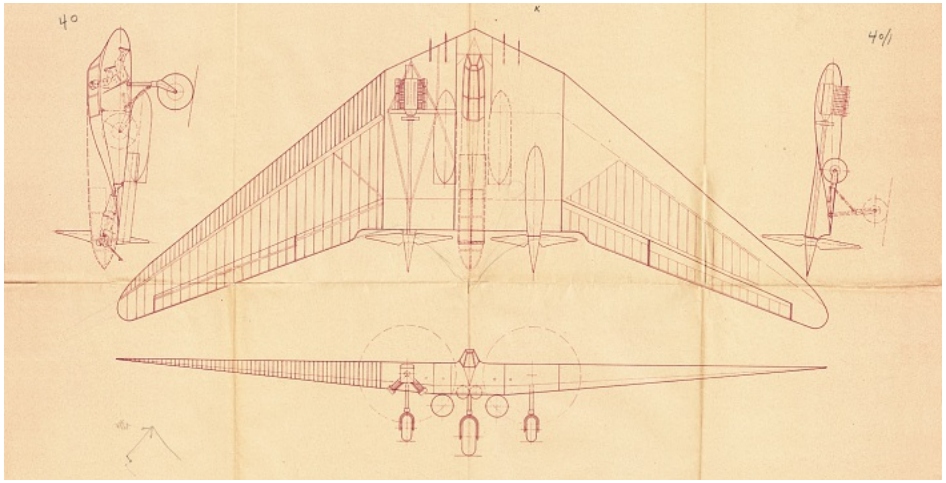
This was of relatively little concern to the Hortens, however, who simply set about using the resources they did have to pursue other projects while the H IX V1 prototype was slowly taking shape, including the H VI high-performance sailplane, the high-speed test type H X, the H XI aerobatic sailplane, the H XII commercial two-seater, the H IIIe sports aircraft and the H XIII high-performance glider.

As scheduled, the unpowered H IX V1 was ready on March 1, 1944 – albeit with a Heinkel He 177 tail wheel assembly as its nosewheel, main landing gear wheels from a Messerschmitt Bf 109G, components from a captured B-24 Liberator and other assorted bits and pieces from a damaged Me 210.

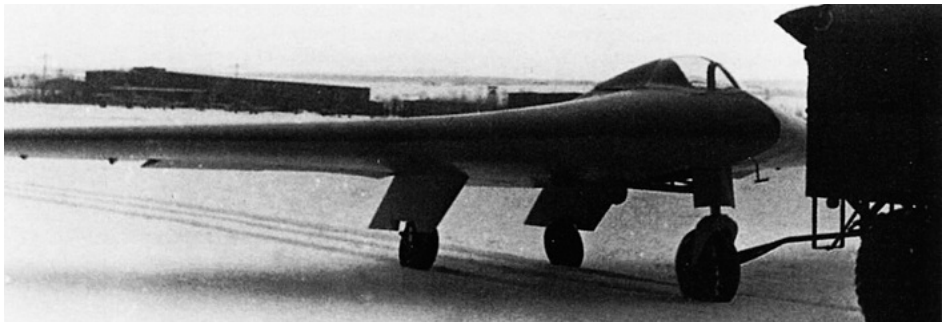
Bad weather delayed its first flight until March 5, 1944. Towed up to 3600m by a He 111, the H IX V1 glided back down to the runway but on touching down the pilot found he was unable to brake effectively and retracted the nosewheel, putting the skidding aircraft's nose onto the ground, to avoid colliding with a hangar.

There were more tests on March 23, then April 5, when the nosewheel failed of its own accord and had to be modified once it was fixed. Later that same month, a team from the DVL arrived to assess the H IX for stability with various in-flight instruments. The resulting report showed that the type – lacking in any form of vertical stabiliser – did indeed have problems in this respect.

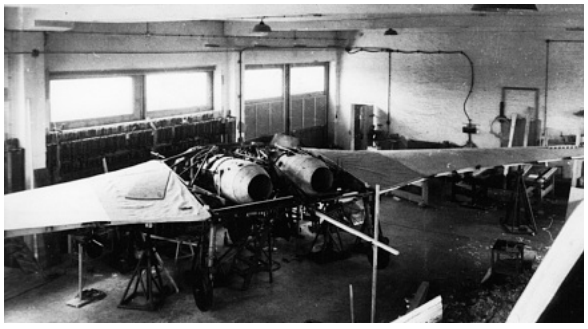
The H IX was originally to have BMW 003 engines but these were still unavailable by early 1944 with no fixed date for delivery, so the second H IX prototype was built with Jumo ▶

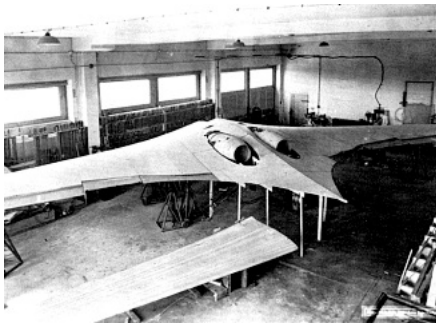


ABOVE: The Horten brothers had been working on twin-engine tailless designs for several years before commencing work on the H IX, later known as the 8-229. This Horten drawing shows a version of the H V from March 19, 1942 – a 'Leichtes Kampfflugzeug' or 'lightweight fighter'. Oddly, it bears the same drawing number as another version produced on March 23, which deleted the second crewman's position – 8-252-0-S1. GDC

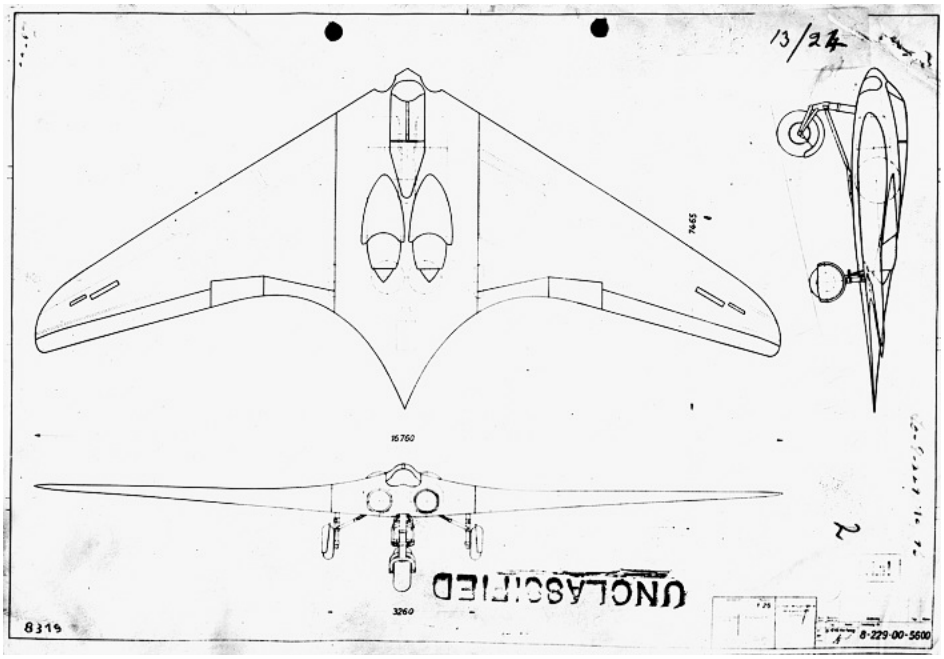


ABOVE: A side view of the H IX V1 from Göttingen in February 1944. via author

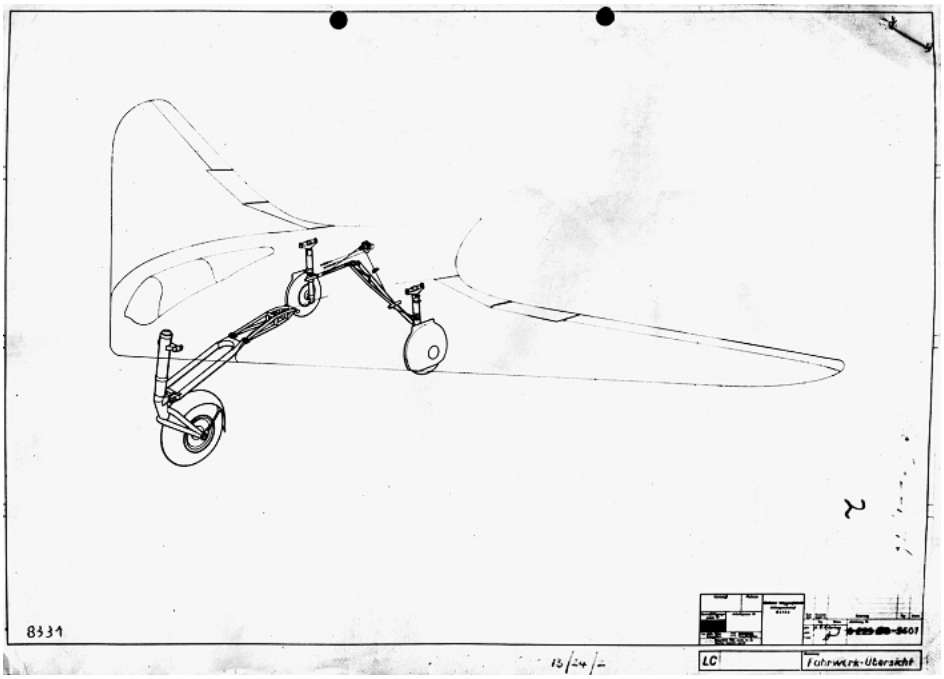




ABOVE: The second prototype H IX – soon to be the 8-229 – under construction. via author



ABOVE: A three-view produced by Gothaer Waggonfabrik, drawing 00-5600, showing the company's envisioned final version of the 8-229 – the Go 229. The intakes are rounder and shallower than those of the original Horten-designed 8-229, the 'tail' longer and the engine fairings shorter, and the front 'lip' of the cockpit canopy curls upwards, a feature not seen on the Hortens' designs. GDC



ABOVE: Gotha's drawing 00-5601 showing the 8-229's undercarriage arrangement. GDC

004s in mind instead. A pair of these arrived in mid-April 1944 but the Hortens were dismayed to discover that in giving them measurements for the powerplant, Jumo had neglected to mention the accessories which had to be fitted to the outside of it – increasing its diameter.

There was no way to squeeze the engines into the airframe without removing all the factory-fitted accessories and then reattaching them once the engines themselves had been installed – a time-consuming process. Therefore, the brothers increased the thickness of the H IX V2's wing to accommodate the Jumo 004 complete with accessories.

The centre section was also widened and overall length increased significantly from 6.5m to 7.47m. Overall, the structure of the V2 changed four times while it was still under construction. This caused substantial delays and the planned date for the first powered flight, June 1, 1944, came and went.

At this point, the SS became involved with the Hortens' venture and on June 15, 1944, the RLM suddenly ordered 10 H IXs. A detachment of 30 SS men was sent to Göttingen to help with the prototype construction work too. Since even the Hortens' expanded Luftwaffe unit was too small to cope with mass production of 10 jet fighters – an order later increased to 20 – the work was handed to Klemm Technik.

As already related elsewhere, Klemm was equally unable to handle large orders, and the work was then passed on to Gothaer Waggonfabrik. Another consequence of this order was that the H IX was finally given an RLM type designation – 8-229.

Gotha's engineers, once they had been handed the construction drawings for the 8-229, were less than impressed. Working with a group of Horten staff designers, they came up with a series of modifications and alterations which were to be implemented on the 8-229 V3, V4 and V5 the first examples to be built at Gotha since the V2 was still under construction at Göttingen.

A devastating bombing raid on the Gothaer Waggonfabrik factory at Gotha on July 20, 1944, caused further delay. The first prototype to embody all the modifications was to be V6.

By November 1944, work was still ongoing and the V2 was still not ready for flight testing with its pair of Jumo 004s. The minutes of the EHK meeting on November 21-22 state, under the heading 'flying wings': "The Ho 229 was to be developed in conjunction with Gotha, and three prototypes of the Horten VII were to be completed."

The Hortens themselves were very definite that their aircraft, the 8-229, was to be the Ho 229 – just as the Messerschmitt 8-262 was the 'Me 262'. Gotha, though, had other ideas. In the British report German Aircraft: New and Projected Types, there are two listings for the 8-229. The first is under the heading 'Horten IX twin-jet fighter' but the second is under 'Gotha 8-229 V6 development of Horten IX'.

It seems likely that Gotha was preparing to hijack the V6 and claim it as its own development – the Go 229. According to the report: "The Horten IX flying wing twin-jet fighter is described in another section of this report. Development of this aircraft was transferred to Gotha and it received the RLM designation 8-229.

"The V6 prototype is powered by 2 x Jumo 004 turbo-jet units and the centre section is rather different from that of the Horten IX, having been thickened by the addition of a shallow bulge on the underside. The jet unit intakes are straight instead of being upswept as on the Horten IX."

The description of the H IX states: "In shape the Ho IX is a pure wing of increased chord at the centre-section to give sufficient thickness to house the pilot and jet units. The centre-section is built up from welded steel tube and the wing tips are of metal. Wing structure comprises one main and one auxiliary wooden spar with plywood covering. All fuel tanks are housed in the wings.

"A retractable undercarriage and a castoring nose wheel is fitted. Elevon controls and drag rudder are fitted, also a spoiler and landing flaps.

"Jet intakes are spaced out in the centre section, one on either side of the cockpit, and exhaust over the upper surface. To prevent burning, metal plates are fitted aft of the exhaust and cold air is bled from the lower surface of the wing and introduced between the jet and the wing surface."

FIRST FLIGHT

The Jumo 004-powered 8-229 V2 was finally completed on December 17, 1944, and transported to the airfield at Oranienburg so that test flights could commence. The test pilot, Leutnant Erwin Ziller, had previously flown the H III and H VII. He had also completed several glider flights in the H IX V1 earlier that month.

Reimar Horten himself, years later, said he remembered that the V2's first powered flight was on about December 18 but this seems unlikely. It is reported elsewhere that the aircraft's engines were ground tested on December 23 at Oranienburg and Ziller

underwent twin-jet aircraft training with a two-seat Me 262B-1 on December 29-31.

Just as it seemed as though some real progress was being made, Reimar halted testing of the aircraft so that he could travel back to Bonn and spend Christmas with his parents and Walter. During this time they worked together on designs for another RLM requirement – a long range bomber capable of attacking New York, the 'Amerika Bomber'.

When the brothers' break ended, they continued to work on a multitude of other designs while allowing Gotha to get on with makings its modifications to the 8-229.

The first flight of the 8-229 V2 finally took place on February 2, 1945. Ziller took the aircraft up but did not retract the undercarriage. He reached a speed of 300kph before bringing it back down for a normal landing. The following day, Ziller went up again and, it is believed, demonstrated the aircraft alongside a Me 262 in flight, but this time deployed the brake parachute too soon on landing, causing damage to the undercarriage struts when the aircraft touched down hard.

During mid-February, the brothers broke off work on their Amerika Bomber, the H XVIII, to design a two-seat night fighter version of the 8-229, since the type's rival, the P-60 had been modified by Gotha to compete in the Schlechtwetter und Nachtjäger competition.

On February 18, 1945, Ziller took the 8-229 V2 up for its third powered flight. He made three passes over the airfield so that a team from the Rechlin test centre could make speed and altitude measurements – apparently clocking up 795kph (494mph) at no more than 2000m. After three-quarters of an hour in the air, the right engine gave out and Ziller made a final approach to bring the aircraft in to land. He tried several times to restart the engine but without success.

At about 400m he put the landing gear down – too soon. The landing gear hydraulic system was normally powered by the right engine so Ziller had to use a compressed air emergency backup, which did not allow the gear to be raised again once it was lowered.

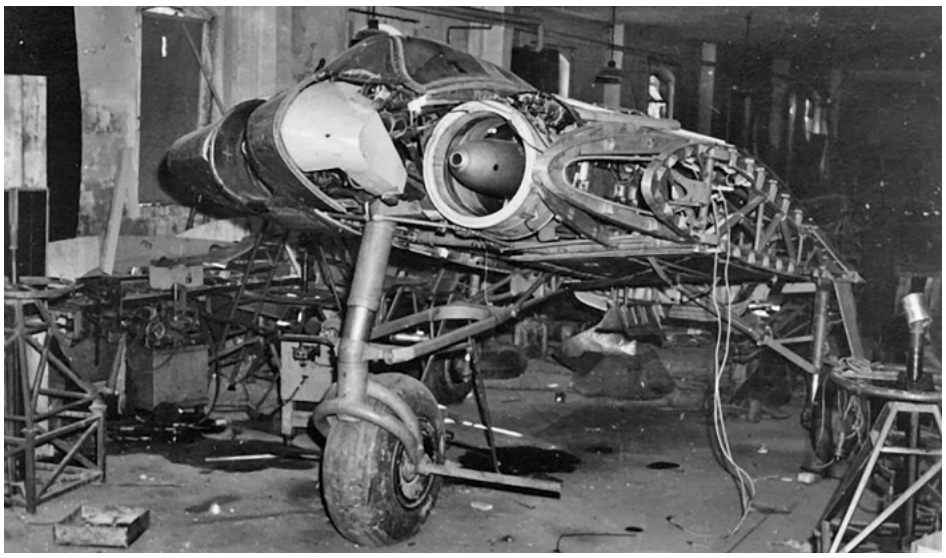
Realising his mistake, Ziller powered up the remaining engine but the drag produced by the gear was too great and its airspeed could not be increased. The aircraft then entered a broad turn to the right which it maintained until it hit the ground. The impact was so great both engines and Ziller himself were thrown from the aircraft. He hit a tree and was killed instantly.

It has been suggested that Ziller was rendered unconscious by engine fumes entering the cockpit during these final moments, which would explain why he made no further efforts to recover the dive after the aircraft entered its wide turn. It was found that his harness, though torn open by the force of the impact, had not been unfastened, and he had made no attempt to activate the ejection seat either.

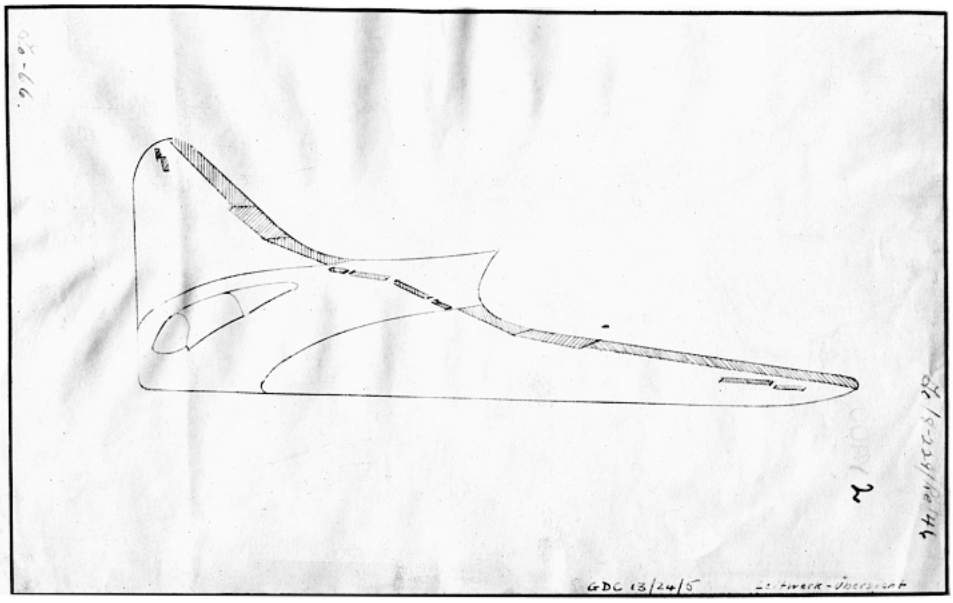
Five days later, Oranienburg was evacuated ahead of the advancing Russian army. The final flight of the H IX V1 was made during this time, resulting in another crash landing which damaged its undercarriage. Gotha continued work on the 8-229 during early March but the programme was finally cancelled before the end of the month.

In summary, the British report stated: "Four prototypes were commenced, designated V1 to V4. V1 is the prototype with twin BMW 003 jet units. The airframe was completed but the jet units were not installed. It was converted to a glider and flown extensively.

"V2 was completed with 2 x Jumo 004 units and crashed after only two hours flying due to pilot error. V3 was under construction as a prototype of the series production version. V4, a two-seat night-fighter with an extended nose, did not get beyond the project stage." ●



ABOVE: The partially completed 8-229 V3, captured by the Americans at Gotha's Friedrichroda facility after the war. via author



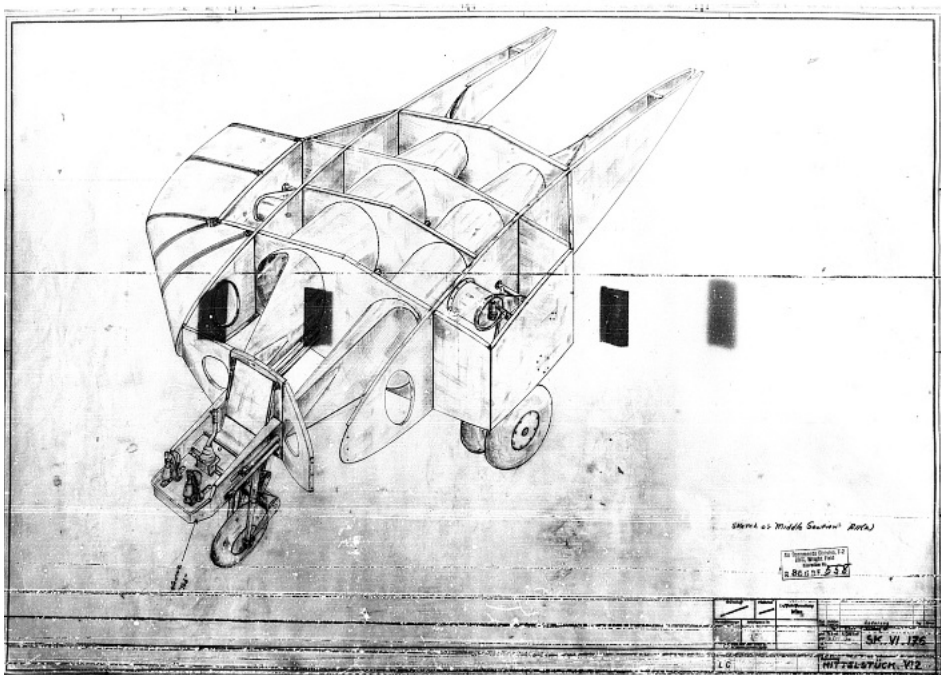
ABOVE: The control surfaces of the 8-229. Note the rounded, rather than upwardly curled, forward lip of the cockpit canopy, presumably denoting an earlier version of the design. GDC

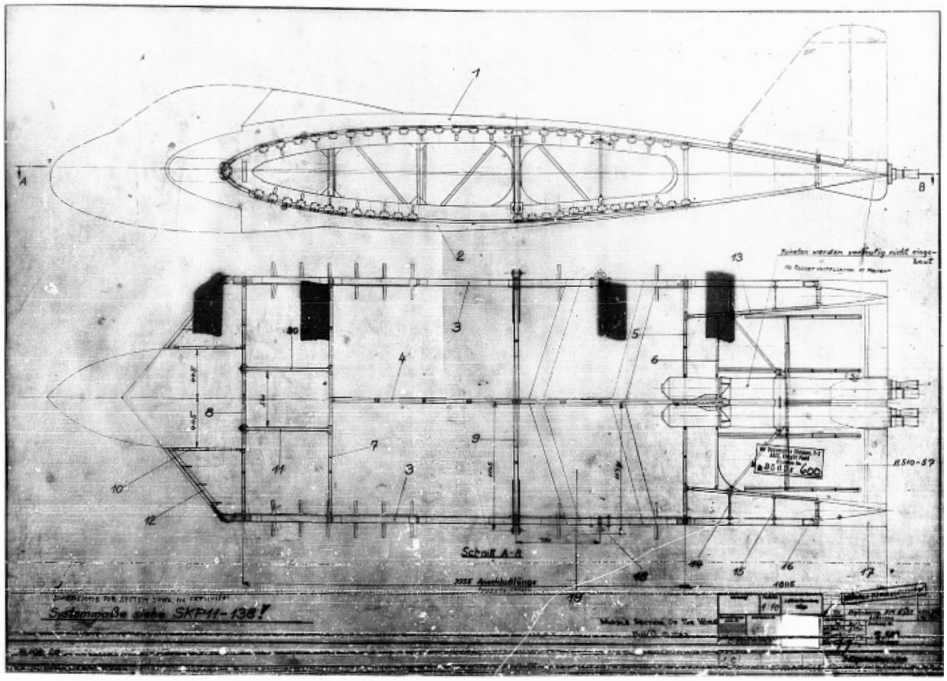
BELOW: The Horten 8-229 V2, with jet engines installed, undergoing ground tests at Oranienburg. via author

The Power Wing

Lippisch P.11 / Delta VI

Having left Messerschmitt in April 1943, Alexander Lippisch went to Vienna to become the head of the Aeronautical Research Institute in Vienna. Here he continued to develop an enlarged turbojet-powered version of the Me 163 – the P.11. Less than a year later, it had changed out of all recognition…





ABOVE AND BELOW: As the P.11/Delta VI evolved from a drawing board project into something that might actually be built, Lippisch wrestled with how to lay out its structure so that the turbojets would be adequately supported. via Scott Lowther

While Alexander Lippisch's move to Vienna marked a new beginning in some ways – free from the internal politics of working within the Messerschmitt organisation – it was business as usual in others.

A report made up of extracts from Technical Intelligence report no. A.424, compiled for the Aeronautical Research Council on August 13, 1945, notes: "Several reports on aerodynamic and gasdynamic subjects were brought out by Lippisch and by his collaborators. The development of a high-speed experimental aircraft with two turbojet engines was started in the summer of 1943.

"It was an all-wing, tailless aircraft with 45sq m area, untwisted sweepback wing with symmetrical laminar section. It was designed for a gross weight of 8000kg."

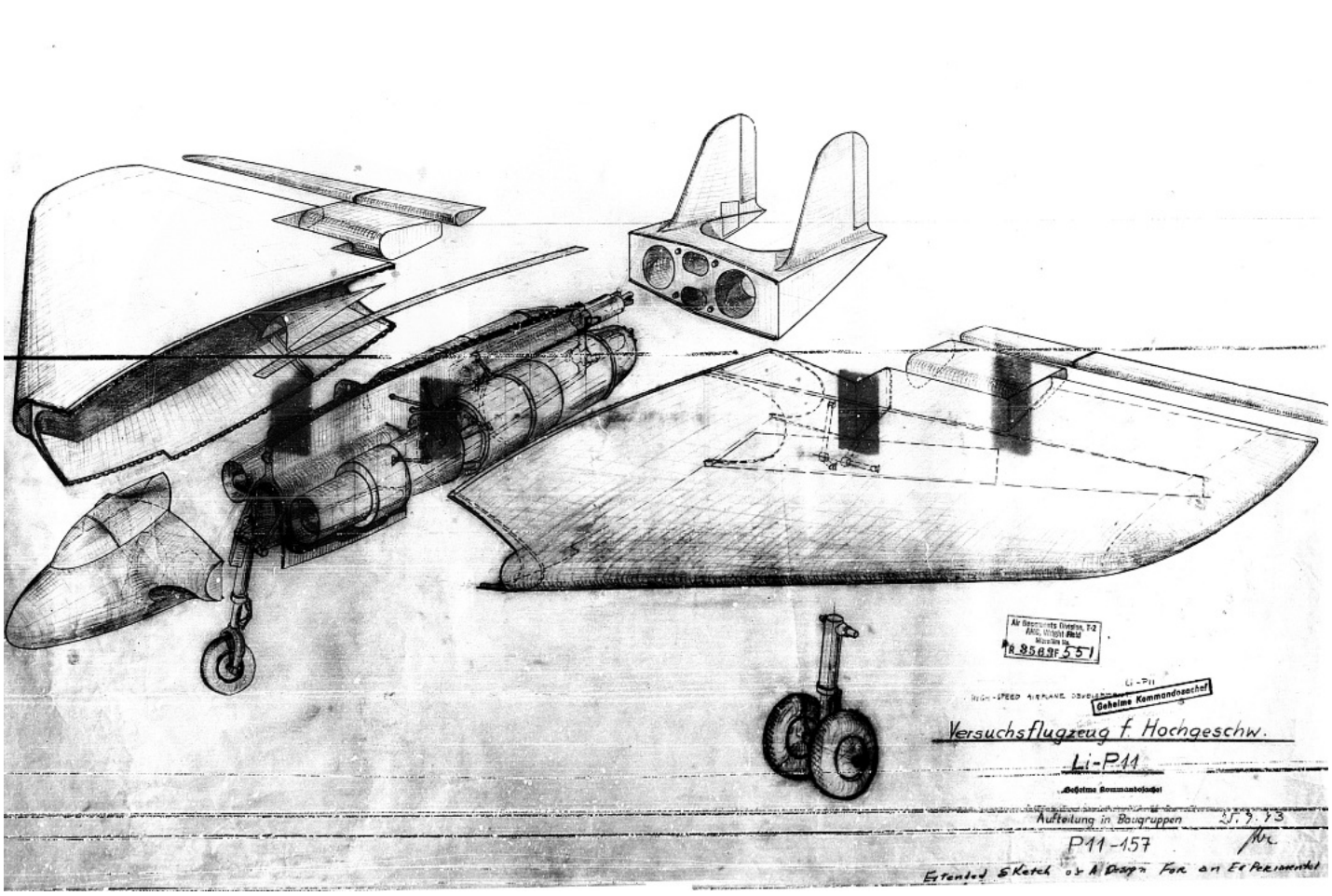
The aircraft in question was the P.11. In its original form, designed while Lippisch was still working at Messerschmitt in September 1942, the P.11 was a fast bomber – a two-seater enlarged version of the Me 163 with a pair of turbojets mounted within the fuselage, their intakes level with the cockpit on either side.

Eight months later, the P.11 had evolved into something quite different, while still retaining the basic premise of a tailless aircraft with two turbojets which had their intakes beside the cockpit.

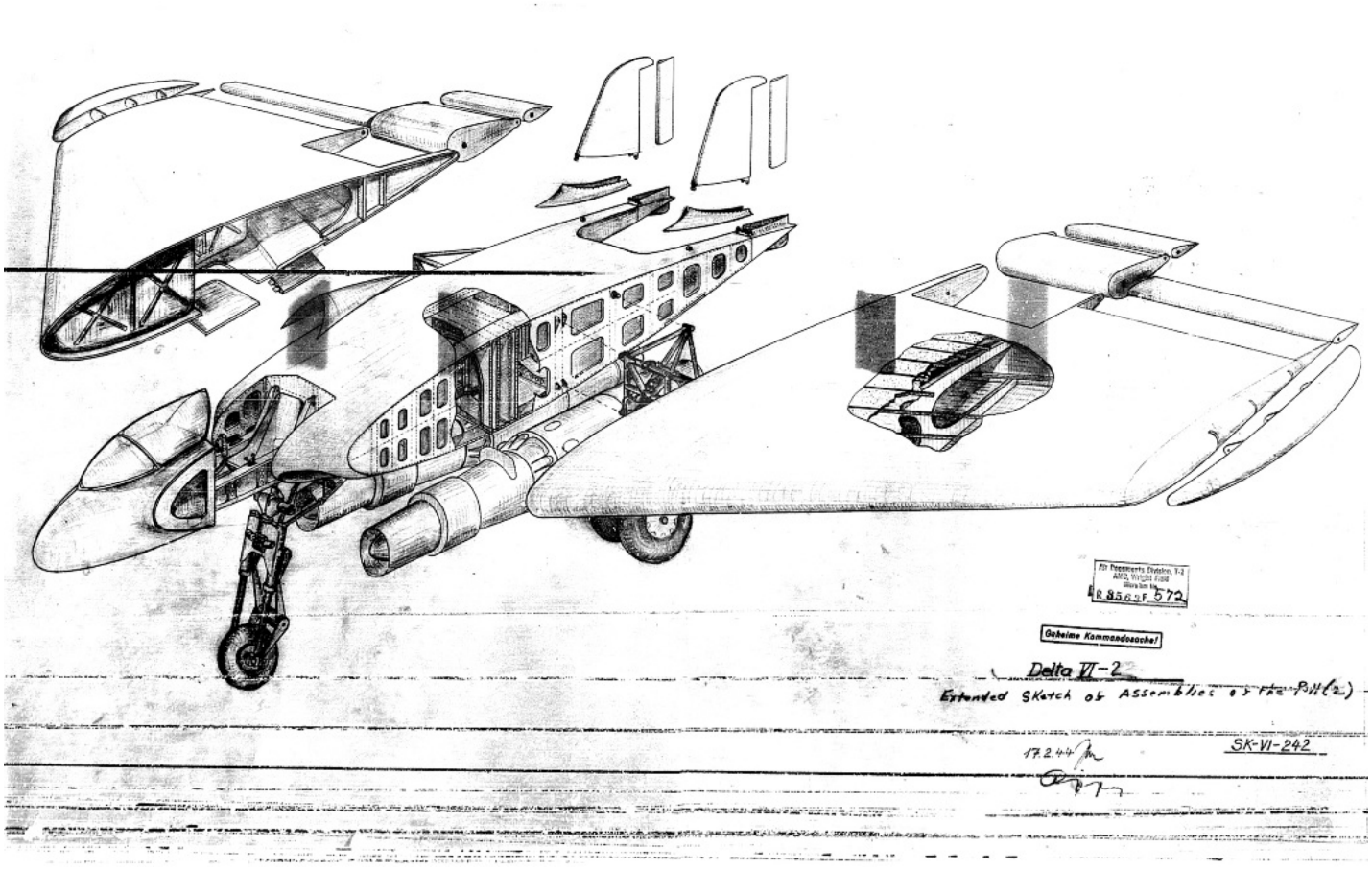
Almost all traces of a central fuselage had vanished – with only a single huge delta-shaped wing remaining, with the cockpit protruding from the centre of the leading edge with the turbojet intakes alongside. Close to the recessed engine exhausts in the middle of the straight trailing edge of the wing were two vertical fins. Each side of the wing contained a large fuel tank.

In German Aircraft: New and Projected Types, this version's specifications are given as: "Span: 35ft 3in. Wing area: 538sq ft. Aspect ratio: 2.3. Overall length: 23ft. Propulsion units: 2 x Jumo 004. Fuel tankage: 720 gal. All-up weight: 16,000lb. Undercarriage: Tricycle. Armament: 2 x MK 103 or 1 x 'large calibre' gun. Maximum speed: 645mph at 19,500ft. Cruising speed: 528mph. Range: 1860 miles."

There were many other armament options, however. A heavy fighter version had four forward-firing MK 103s and a single rearward-firing MG 151. And a fast bomber version had two MK 103s at the front and a huge faired 'pod' slung underneath containing a massive SC1000 bomb.



ABOVE: An early design for the Lippisch P.11 showing its stressed skin hollow structure. This was originally how Lippisch intended his fighter to be constructed. via Scott Lowther



ABOVE: As work progressed and the P.11 came closer to becoming a reality, Lippisch abandoned his earlier plan for a hollow structure and adopted a more conventional internal layout instead. The name changed too – with the designer referring to the 'Delta VI' rather than the P.11, although they were the same thing. via Scott Lowther ▶

RIGHT: Another view of how the engines were to be arranged within the P.11, before it became the Delta VI. via Scott Lowther

BELOW: Had the war gone differently, and had the Delta VI reached operational service, it might have been required to fight in North Africa.
Art by Chris Sandham-Bailey

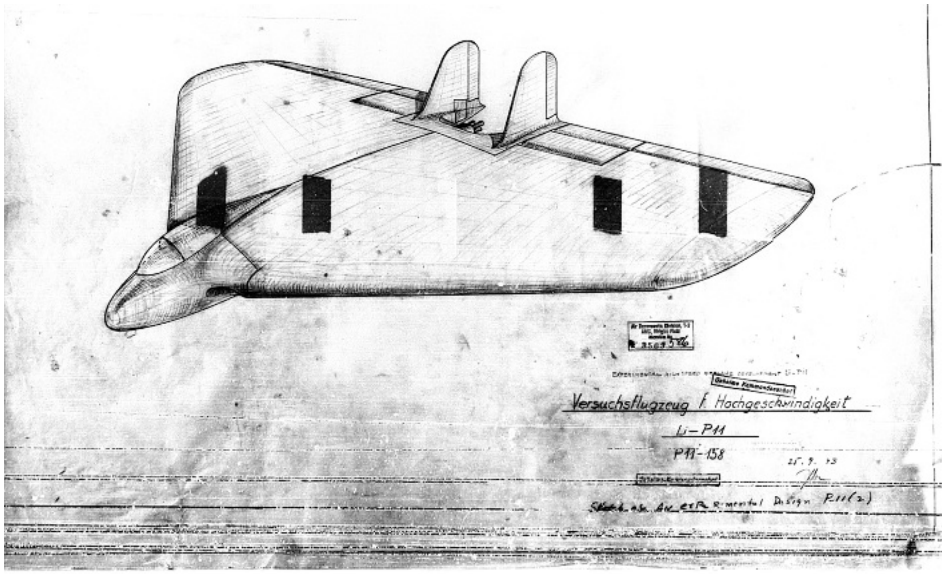
Lippisch received a development contract for the P.11 from the RLM in October 1943 and began work on constructing a mock-up with the aid of a former furniture company in Vienna. Drawings of later versions from May 1944, now labelled 'Delta VI', featured up to five MK 108 cannon.

In a lecture entitled The Power Wing (All-Wing Jet-Propelled Aircraft), given in Vienna at around that time, Lippisch explained the idea behind this 'all-wing' design.

He said: "It is known that even before the world war, Hugo Junkers first expressed the novel conception of the all-wing aircraft. This was the first idea breaking away from the pattern of the bird for the further development of the aircraft.

"As a living creature the bird has multifarious functions to fulfil; the aircraft however has only to fly; and to fly as economically as possible. This means reducing drag to the utmost limit, which is realised when the whole of the surface swept by the wind performs lifting work.

"But this means the elimination of the fuselage and tail unit. The wing is inherently stable and controllable and all loads and useful spaces are contained inside this flying wing.



ABOVE: A sketch of the P.11 from September 1943, when the design was attracting attention from the RLM as a viable fighter prospect. via Scott Lowther

Junkers himself, however, still could not dispense with the tail separate from the wing."

He said the first manned all-wing aircraft had been the Delta I, built by himself in 1930-31 "with the assistance of the ocean flier Hermann Köhl. It would take too much time to tell you of the long road, hampered by much lack of knowledge, which has led to the latest models.

"In any case, the all-wing aircraft must be of a definite absolute size in order to be of sufficient volume to accommodate all the loads, and in the case of smaller aircraft, intermediate forms of the so-called tailless aircraft have been necessary in order to prove, in spite of the limited possibilities, the superiority of this type of craft.

"The high speed aircraft Me 163A, built by the Messerschmitt AC under my direction, did not merely achieve the purpose of producing essentially improved flying qualities compared with those of the normal aircraft, but it succeeded for the first time in advancing into a new speed class, into the range above the thousand kilometre limit.

"It is known that one of our latest operational machines, the Me 163B, which recently for the first time was used in service with positive results, grew out of this aircraft. But it too is hampered by reason of the power plant; which as a machine is quite simple but has a fuel consumption of about 20 times that of the Otto engine.

"An aircraft able to fly at these speeds for several hours will shortly begin its first tests. This is the Delta VI, which is fitted with two air-jet turbine engines. In order to house the power units completely in the wing, a definite thickness and length of the latter was pre-

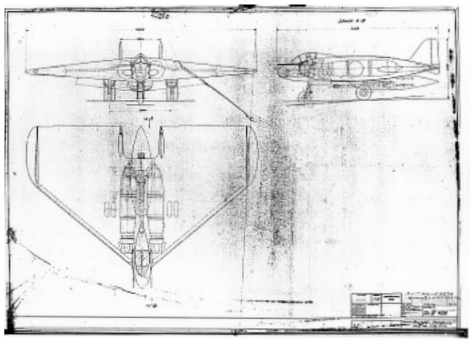
requisite, but this meant that all the other dimensions had necessarily to be a compromise if the aircraft were not to fall short of certain minimum performance.

"In the course of designing this aircraft, I thought of going a step further than Hugo Junkers and constructing the wing not only as load carrier, but at the same time as the propulsive system. Nature has solved this problem most skilfully in another form.

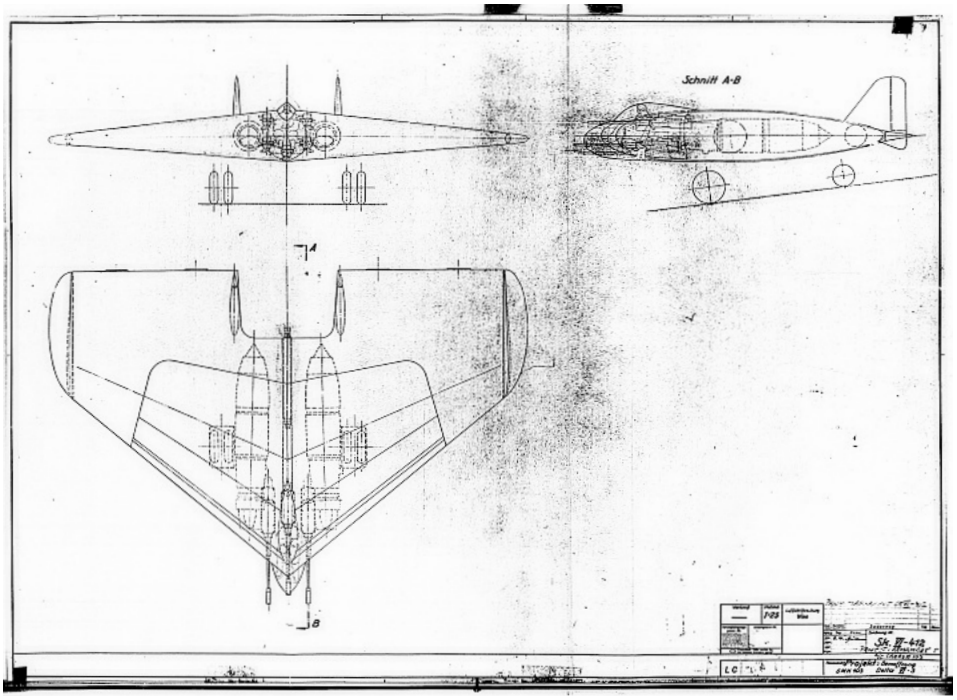
"We are however not concerned here with the biological but with the technical physical aspect. Unlike the usual type of construction, the Delta VI has already a completely hollow wing and the strength is afforded by the hard non-buckling shell."

After outlining this monocoque construction, he then went on to explain his newest idea, the P.13, which is covered here in the following chapter.

It seems that even as he was giving this lecture however, Lippisch was having doubts about installing a pair of turbojets within a



ABOVE:A wide variety of different armament arrangements were suggested for the Delta VI. This one shows an enormous underslung cannon – presumably a 75mm, though this is not made clear. via www.deutscheluftwaffe.de



ABOVE: Another armament arrangement, this time showing the Delta VI with five MK 103 cannon. via www.deutscheluftwaffe.de

"completely hollow... hard non-buckling shell", which would have no doubt required a level of craftsmanship and engineering skill that was in short supply in late-war Germany.

Later drawings of the P.11 show the aircraft with a conventional internal structure.

Work began on building the Delta VI V1 prototype but a disastrous event occurred in June 1944 which effectively killed the project off at a stroke.

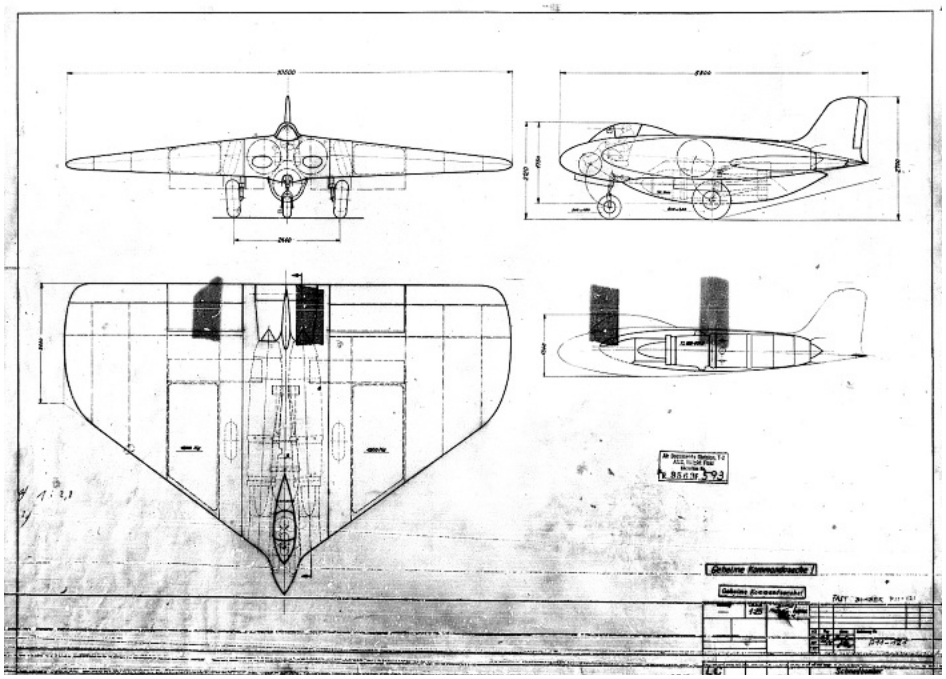
According to Technical Intelligence report no. A.424: "The construction of this aeroplane was started in a factory in Vienna which was bombed out in June 1944 by the American Air Force.

"By this event Dr Lippisch lost 43 of his collaborators. The factory was then rebuilt in the Wiener Wald but the first experimental aircraft of this all-wing type, Li P.11, was never finished as the Russians invaded the region of Vienna."

In the book he wrote summarising his life's work, Ein Dreieck Fliegt, Lippisch gives the number of deaths as 45, but this was written some 30 years rather than 14 months after the event. Vienna was bombed twice in June 1944 – on the 16th and 24th. It seems more likely that the June 16 attack was responsible for damaging the LFW's premises.

It seems that after this calamity, Lippisch abandoned the P.11/Delta VI and focused all his efforts on the P.13, which he viewed as more promising due to its novel and, he believed, revolutionary powerplant.

The minutes from a meeting of the EHK on November 21-22 state "the Lippisch P.11, a parallel development with the Ho 229, was to be developed in collaboration with Henschel" but this does not seem to have come about. ●

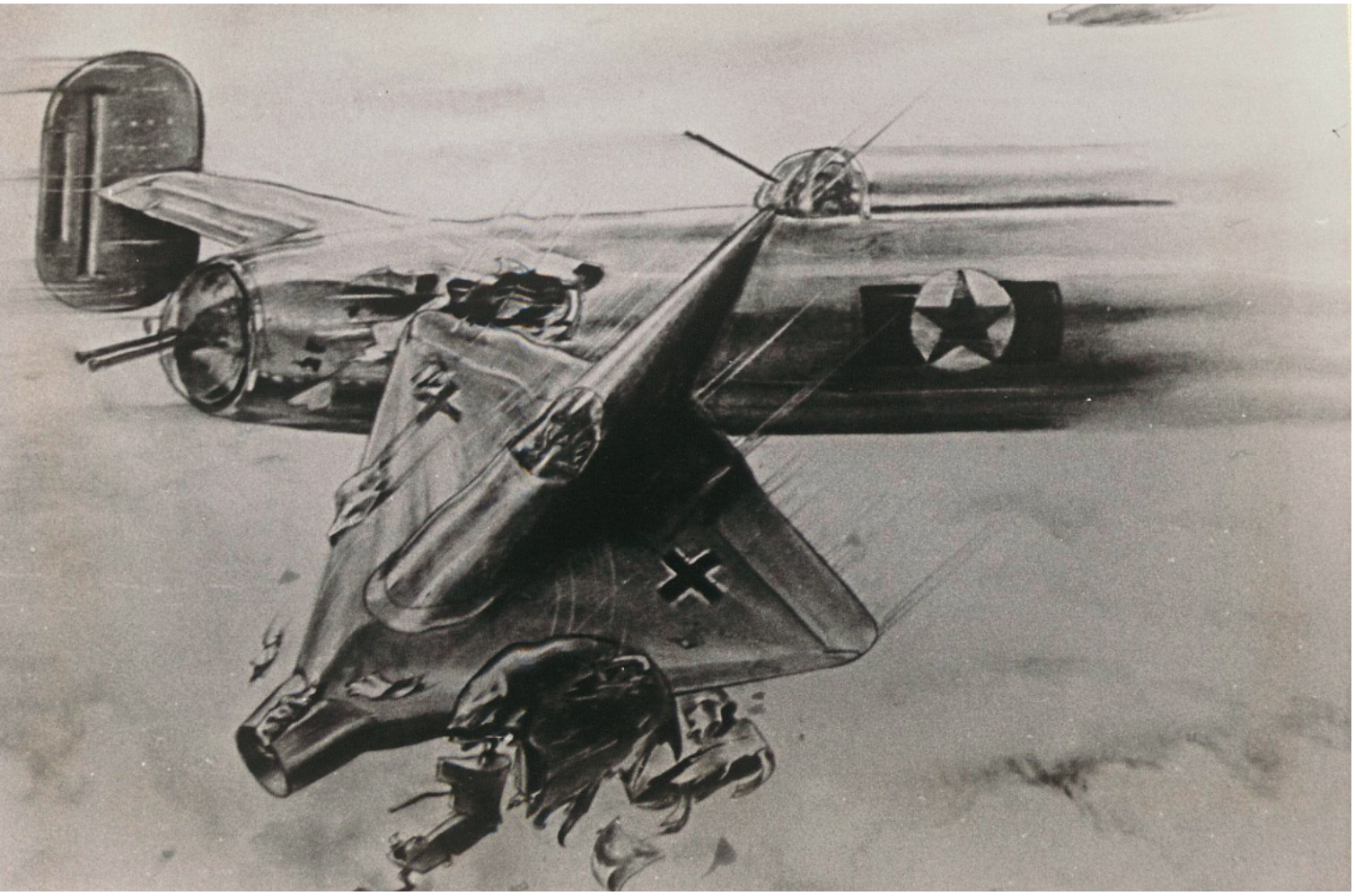


ABOVE: The P.11 was originally pitched as a multirole aircraft. One of its functions was that of fast bomber, as depicted here. via Scott Lowther

'Darts of death'

Lippisch P.12/P.13a, P.13b and P.15

During the late summer of 1943, while working on the P.11 at Vienna, Alexander Lippisch came up with an idea for a manned rocket-powered ramming aircraft. At around the same time he also became interested in Lorin-type ramjets. Bringing the two together resulted in the arrowhead-shaped P.13a fighter.



ABOVE: Artwork from the original P.13a project brochure. No armament was ever planned for the P.13a despite dozens of blueprints being drawn up. It was designed to ram Allied bombers. TNA

Physicist Paul Karlson, author of Du und Die Natur, published in English as You and the Universe: Modern Physics for Everybody in 1938, produced a report on September 9, 1943, based on an idea conceived by his friend Alexander Lippisch.

It was entitled Ramm-Raketen nach Dr Alexander Lippisch, Wien or 'Ram Rockets According to Dr Alexander Lippisch, Vienna' and it discussed the idea of building a small but very strong rocket-propelled aircraft capable of surviving multiple collisions with enemy aircraft.

He wrote: "In fighter pilot circles the ramming collision is discussed seriously as the only really certain method of attack. To make it possible Dr Alexander Lippisch has sketched a novel flying device that can be described as a ram rocket.

"The proposal does not originate from a fantasy but from the ranks of our flyers themselves, that is, men who know what they are saying and are prepared to test fly it at any time during its deployment.

"A desirable ideal defence aircraft would be one that takes-off on an air-raid warning and flies straight towards the target – like an anti-aircraft shot but with the possibility of correction in flight that is lacking with a shell.

"The aircraft must be simple and easy to operate, and able to be produced promptly and in great numbers with the technical resources on hand today. It should lead with certainty to the total loss of the enemy aircraft, not just damage as is the case with shelling.

"Any remote control from the ground possesses the disadvantage that the control is all the more difficult the higher the projectile – that is, the nearer it is to the target. The best guidance is and remains the human being, the daring resolute fighting man."

This "avenging rocket force" would act as a terror weapon to break the fighting spirit of the Allied bomber crews: "The effect on morale of this weapon must be terrible: the enemy crew sees the piloted projectile racing up from the ground without the slightest possibility of defence.

"A whole swarm of such darts of death rush closely side by side in parallel trajectories at the squadron and in only a second the act of destruction begins and ends."

The aircraft would consist of a steel tube fuselage with a solid ram at one end, a cockpit in the centre and three heavy duty swept back wings to the rear. Launched from a ramp, the aircraft would readily slice through lightly built aeroplanes – particularly tail units – before its fuel was expended and the pilot would be obliged to parachute to safety.

This idea in itself came to nothing but the basic configuration and purpose of this rocket-propelled rammer apparently remained in Lippisch's mind. After winning a contract to develop the P.11 in October 1943, he was able to bring together more resources for his research and development efforts, and the project that interested him the most was Lorin-type ramjets.

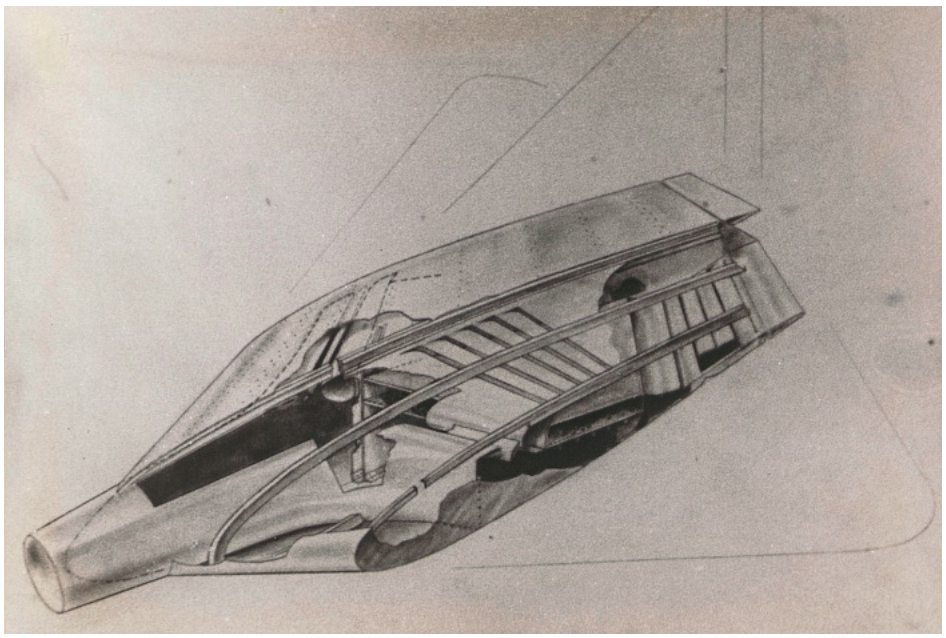
As a concept, the P.11 was a flying wing and Lippisch wondered what might happen if such a wing could be turned into a propulsive system in its own right. During the same 1944 lecture in Vienna where he outlined the P.11 as a 'power wing' be also revealed his thinking regarding another new type he was in the process of developing.

Having explained that the P.11/Delta VI would be of hollow monocoque construction, he said: "The question is, how would it be if this hollow wing were to be fully utilised by being itself made into a propulsive system, and a power unit were then to be built, not on mechanical, but only on aerodynamic thermal principles?

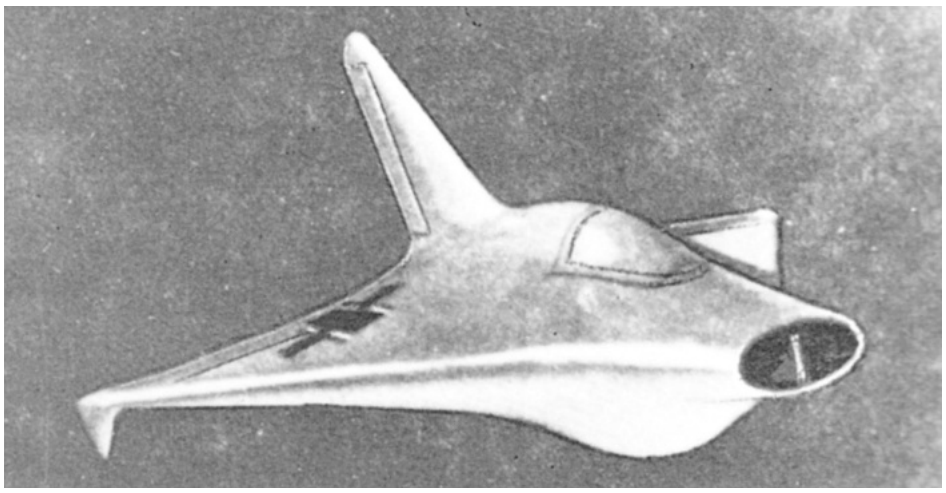
"We should then have the lift-producing airflow on the outer skin of the aircraft and the propulsive flow of heated gas within the hollow wing.

"We must finally dispense with the levers and aircrews with which, indeed, nature cannot be forced into the manifestation of her laws. We must break away in aircraft construction from the tradition of the fixed machine, from the age of the piston engine, and think solely in terms of the laws of flow. Only then shall we be able to produce the real flying machine.

"Only then shall we succeed in so simplifying the aircraft that the designer, instead of being hampered by many small difficulties, will be free to allow his thoughts to follow the broad clear lines of the fundamental laws of flow."



ABOVE: The refined form of the P12/13 combined ramjet/wing centre section. This was the basis upon and within which a variety of different fin and cockpit combinations were mounted. TNA

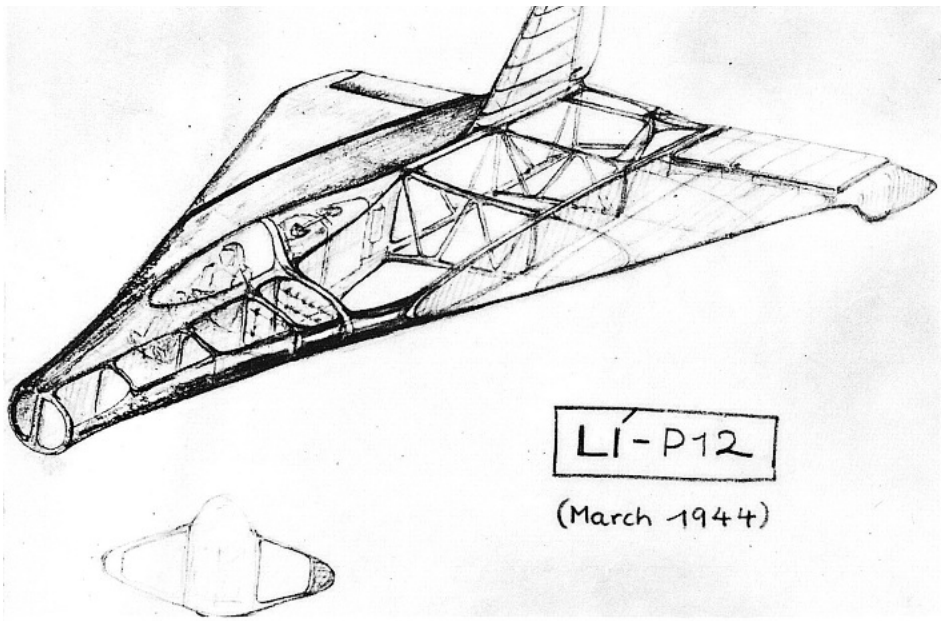


ABOVE: A slightly touched up photo of the P.12 model. The bulge beneath the ramjet/wing unit is the bulky landing skid arrangement. via author

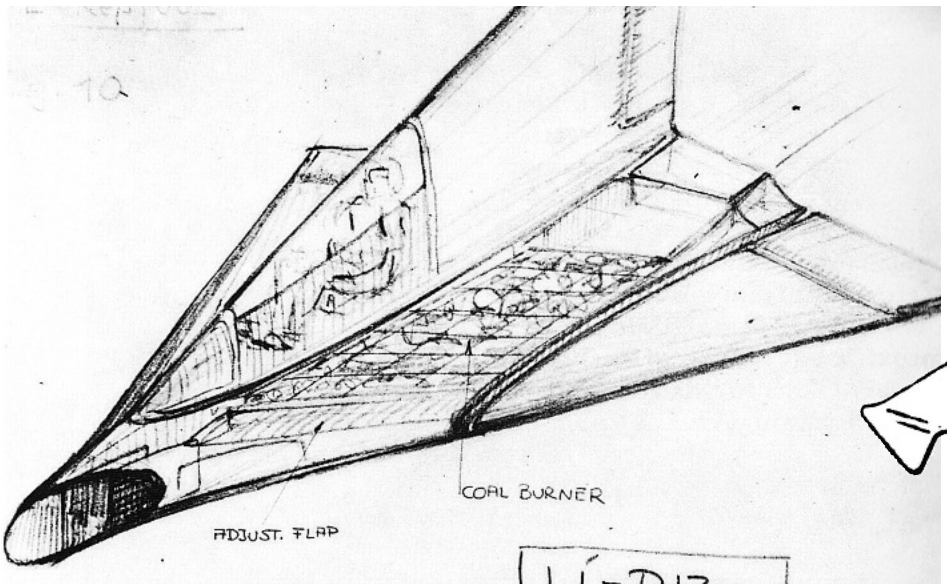
After explaining how a ramjet works, he showed his audience a diagram of his latest design and told them: "The diagram shown here refers to the project on which we are working at the present time. The aircraft has the Lorin propulsion system converted into a wing in order to obtain the most favourable conditions at high speeds.

"The wing is completely filled by the power unit. The pilot's cockpit has been moved to the rudder unit. The fuel, in this case pulverised coal, is placed on an oblique grating and is blown through upwards from below. To control the combustion, part of the compressed air can be blown directly into the combustion space above the grating, so that only a part of the sucked-in air is burnt.

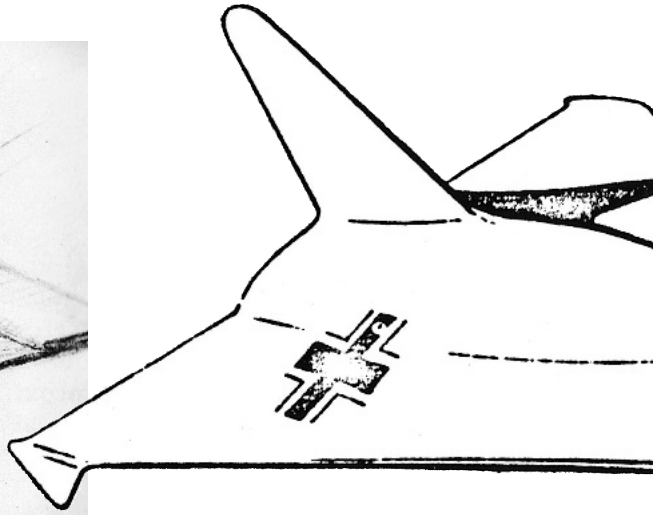
"The exhaust is along the trailing edge, above and below which flaps are arranged enabling the outlet opening to be regulated. With these flaps on the trailing edge and the ▶



LEFT: At first, Lippisch believed his new fighter would use a liquid-fuelled ramjet – and he called the project P.12. This sketch, drawn by Lippisch himself for the Americans after the war, shows the positioning of the liquid fuel tanks behind the cockpit, which is sunken into the centre section. A split intake moves incoming air around the cockpit to the burners, positioned immediately left and right of the pilot. The hot air then passed through the open structure of the airframe before exiting at the rear, providing thrust. via author



ABOVE: Another sketch by Lippisch for the Americans, but this time showing both an alternative fin/cockpit arrangement and a different power source – a grate of coal instead of liquid fuel to power the ramjet. The forward intake arrangement is also different – presumably to improve the type's effectiveness at ramming enemy aircraft. via author



ABOVE: This British drawing, a tracing of a photograph, shows an extended cockpit-into-fin 'bulge' mounted atop the ramjet/wing unit, with 'Lippisch ears' at the ends of the wings. TNA

air flaps inside the power unit the temperature in the combustion chamber and accordingly also the propulsion can be controlled to a large extent.

"The grate must be made large enough to render it unnecessary to refill during flight. The control is effected by means of the flaps on the outer sections of the wing (elevator and lateral control), as well as by the rudder.

"The outlet regulating flaps at the mid-wing trailing edge serve at the same time for trimming. The take-off of such an aircraft is effected either by means of a catapult or sling or by means of starting cartridges.

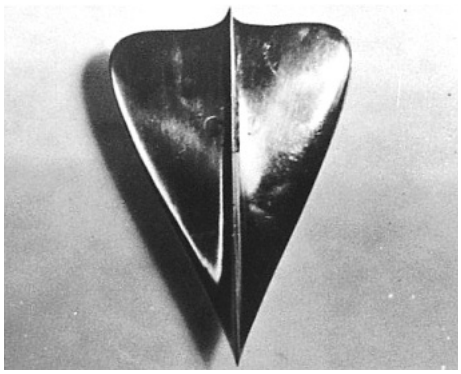
"Thrust can also be artificially produced on the ground by sucking the air by means of a high speed steam jet blower into the diffuser as is usually done in high speed tunnels. Practical tests will decided which of the three starting methods is the best.

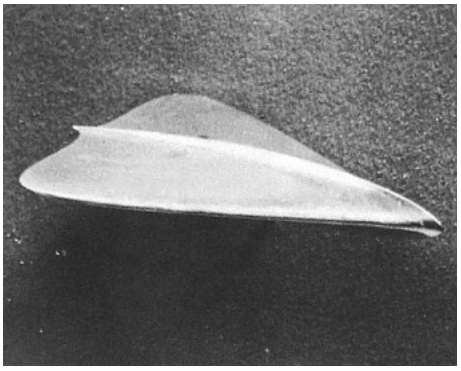
"The undercarriage needed for the take-off will be jettisoned as in the case of the 163A and B, and a skid lowered for landing."

This is an early description of the Lippisch P.12/13a all-wing fighter. Lippisch had devised its basic shape in 1942 while working on the Me 163 but had, until now, lacked a suitably powerful engine to propel it to the supersonic speeds he believed it capable of.

The operation of its ramjet was more succinctly described in British ADI(K) report no. 14/1946, Tailless Aircraft Development by Lippisch: "Basically, the aircraft was to be an all-wing 'delta' type design, the power being derived by passing air over a white hot carbon block specially prepared from bituminous coal, and ejecting the resulting hot gases.

"A maximum thrust coefficient of 0.3 would be attained with the athodyd working at 600-800°C. though the unit had been tested up to 2000°C. The carbon block weighed 1760lb and the entire aircraft two tons: duration was about three-quarters of an hour and the minimum speed 80-100m/sec. It was calculated that the top speed would be supersonic."



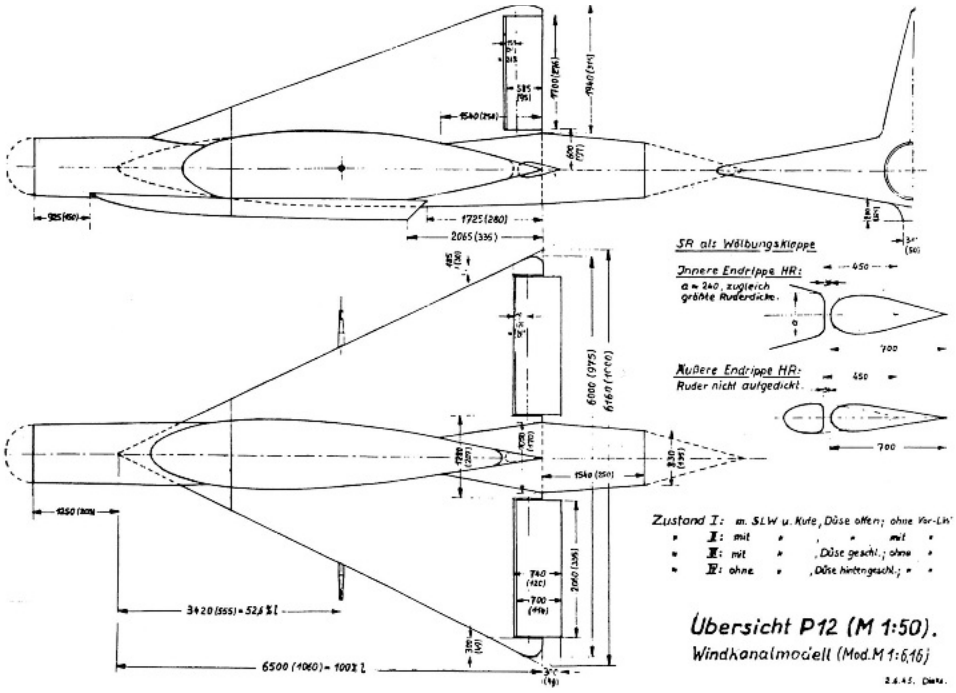


ABOVE: The Lippisch P.12/13 project began with aerodynamic forms devised by Alexander Lippisch during 1942 while he was working on the Messerschmitt Me 163. These arrowhead shapes were the model for the basic P.12/13 platform. TNA

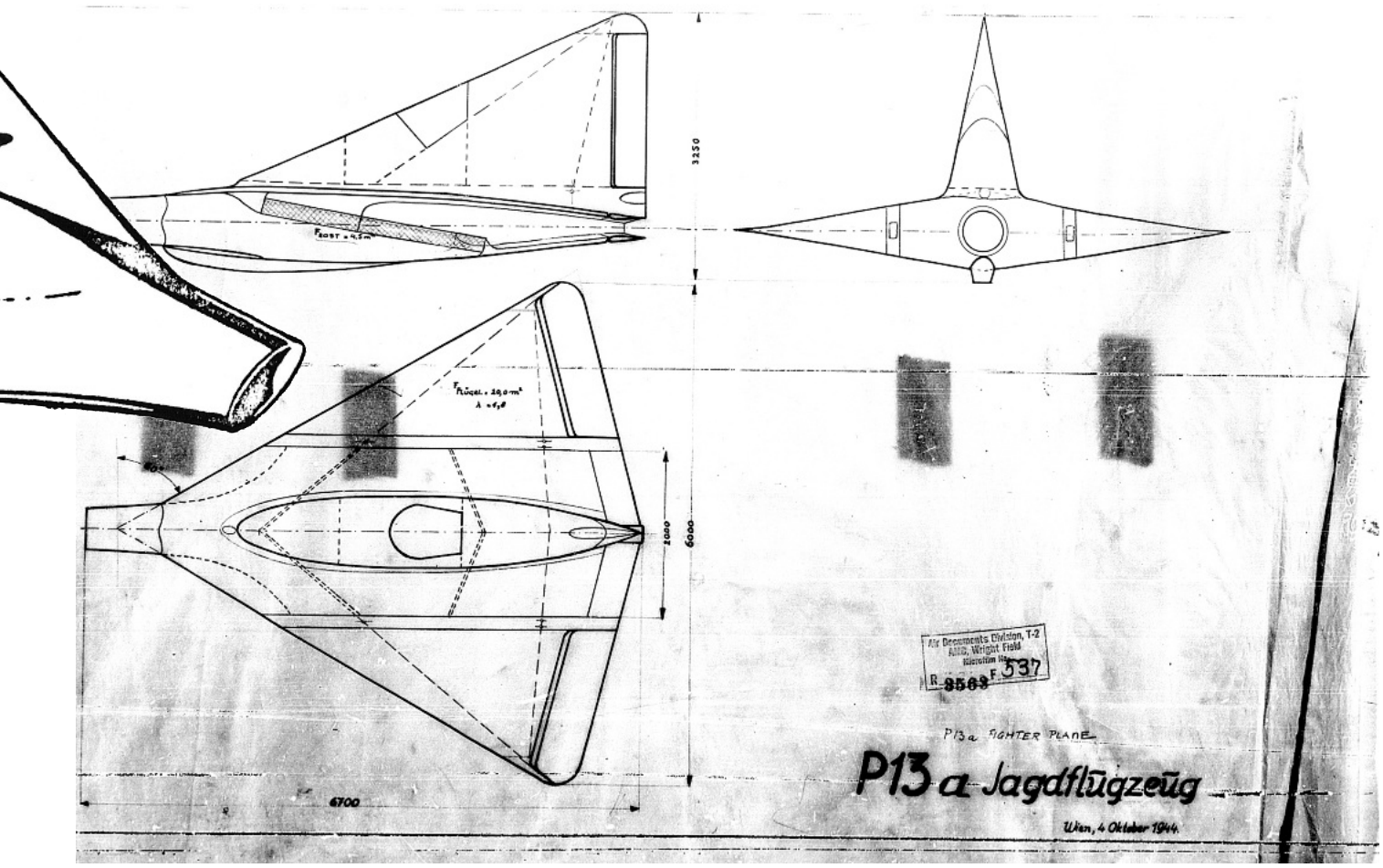
P.12/13A

When Lippisch began to work on all-wing designs powered by ramjets, he was not sure what sort of fuel would best suit his aircraft – liquid or solid. He therefore worked on a series of flat delta-wing designs to house his powerplant and tried putting a variety of different fin and cockpit combinations on top of them and a variety of different intakes at the front of them.

He started out with a cockpit buried in the fuselage with the air entering via a split intake in front of the pilot, passing around him, and



ABOVE: A drawing showing a P.12 (liquid fuelled ramjet) with the cockpit-in-tail fin arrangement more commonly associated with the P.13 (coal fuel). via author

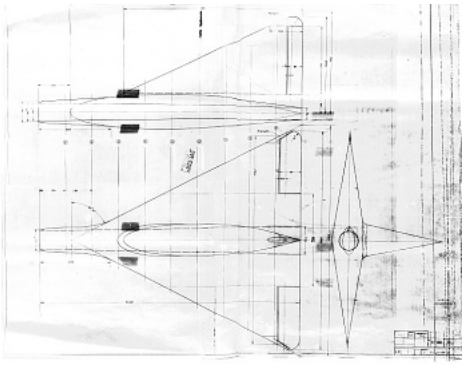


ABOVE: The definitive three-view of the Lippisch P.13a. The side view shows the coal grate slanted at an angle inside the aircraft, while the forward view show two small square apertures in the wings – at the joints where the wings folded upwards – to allow cooling air to flow around the sides of the ramjet combustion chamber. These are often mistaken for gun ports. via Scott Lowther

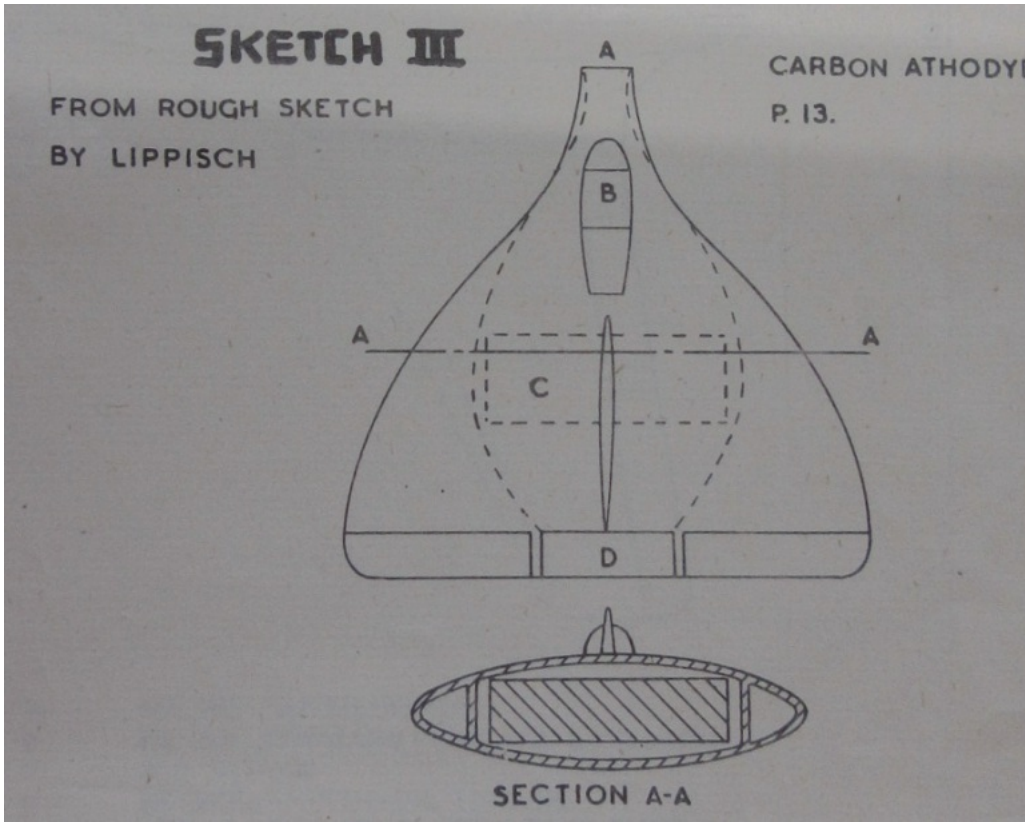
then passing over either the burning liquid fuel or a grate filled with coal. At first he thought liquid fuel was the obvious choice and designated his liquid-fuelled, integral cockpit design the P.12. It had a small vertical fin and rudder at the rear.

Then it occurred to him that solid fuel might work better at high speeds. According to the British report: "The coal burning Lorin unit was originally adopted because of the scarcity of liquid fuel, but
was now thought superior in any case provided a sufficiently large jet cross-section could be used."

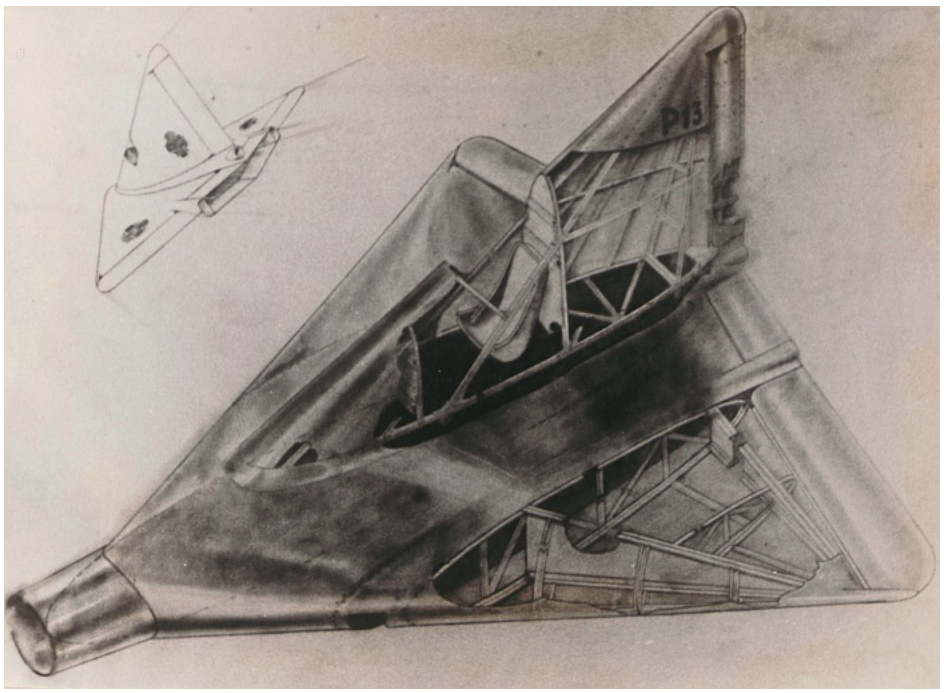
The P.12 form with coal in place of liquid fuel was designated the P.13a. To achieve better



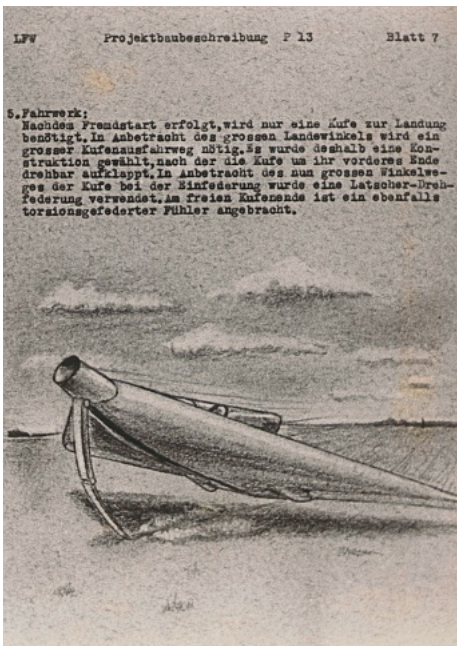
ABOVE: Design drawing showing different intakes for the P.13 and a completely straight trailing edge to the wing. Lippisch produced dozens of drawings throughout 1944 as his design took shape. via Scott Lowther



ABOVE: It is generally believed that the P.12 and P.13 were entirely different types but in reality either could have any arrangement of cockpit/ramjet. The only real difference was the fuel. A liquid powerplant made the type a P.12, a coal one made it a P.13. This sketch shows how a P.13 (coal fuel) would have worked with the cockpit-in-fuselage and low fin arrangement – with air from the intake passing around the cockpit 'B' to then flow over the coal grate 'C'. TNA ▶

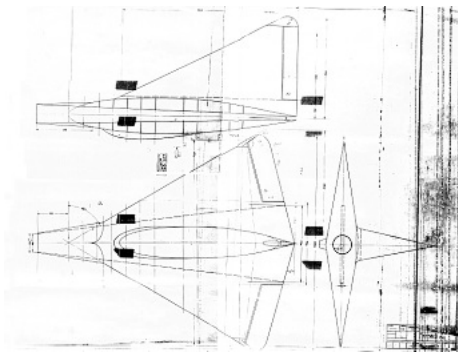


ABOVE: A grainy cut-through of the P.13 from the brochure shows the wing apertures for cooling. TNA

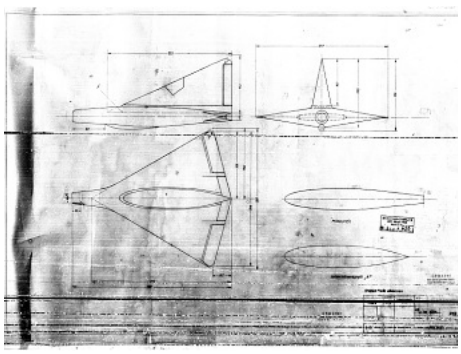

LFW Projektbaubeschreibung P 13 Blatt 7

5.Fahrwerk:
Nachdem Fremdstart erfolgt,wird nur eine Kufe zur Landung benötigt.In Anbetracht des grossen Landewinkels wird ein grosser Kufenauffahrweg nötig.Es wurde deshalb eine Konstruktion gewählt,nach der die Kufe um ihr vorderes Ende drehbar aufklappt.In Anbetracht des zum grossen Winkelweges der Kufe bei der Einfederung wurde eine Latscher-Drehfederung verwendet.Am freien Kufenende ist ein ebenfalls torsionsgefederter Fühler angebracht.

ABOVE: Another page from the P.13 brochure, showing the multi-jointed torsion-sprung landing skid proposed by Lippisch. This also graphically illustrates the high nose-up attitude pilots would have been obliged to use in bringing it in to land. TNA



ABOVE: Yet another different internal structure for the P.13. The intake widens from front to rear and it appears that the coal is positioned above and below to allow a smooth flow of air to a narrower exhaust at the rear. via Scott Lowther



ABOVE: Another P.13 design showing a different internal arrangement with a slightly longer and narrower intake at the front. via Scott Lowther

directional stability, Lippisch hit upon the idea of moving the cockpit out of the fuselage and into a large fin on top of the wing/engine. This also had the advantage of allowing a clear flow of air directly into the ramjet.

"Two fins were designed for the P.13," says the British report. "The large one, about the same size as half the wing, had too much drag, but might be needed for directional stability. Slots were unnecessary and would not have been effective with so large a sweepback."

As with his conundrum over the fuel source, Lippisch seems to have been unable to decide which layout was best – cockpit-in-fuselage or cockpit-in-fin. Although the former is usually associated with the P.12 and the latter with the P.13a, period drawings exist of the P.12 with the cockpit-in-fin configuration and the P.13a with the cockpit-in-fuselage configuration.

Essentially, the only difference between a P.12 and P.13a was the fuel source for the ramjet. The cockpit location and intake form were interchangeable – although the wing/engine shape itself developed over time, starting out with winglets before becoming a more regular shape.

Lippisch carried out wind tunnel tests of a simplified P.12/13a model, with both fin/cockpit layouts, before successfully flight testing it in small fin form at Spitzerberg airfield near Vienna in May 1944

It was decided at this point that efforts should be concentrated on the coal-burning P.13a and a series of experiments was carried out to determine the best variety of coal, its shape and size, and its arrangement within the aircraft.

Under a heading of 'experiments', the British report states: "The first experiments were made with solid fuel in the form of tubes composed of powdered brown (Bohemian) coal and an oxygen carrier to improve burning.

"This coal has a high gas content and gives off considerable H^2 with consequent high flame velocities. The tube forms the lining of the duct and burning takes place along the bore. To ensure adequate heating it was found necessary to impart swirl to the incoming air by means of a fan.

"During tests, tubes weighing about 1kg each were employed and it was found that a tube burned for four to five minutes. The presence of the oxygen carrier in the tube material resulted in uneven burning so that pieces of the fuel broke away and were carried out with the jet stream. It was anticipated that improved mixtures might yield better results."

However, American Technical Intelligence report no. I-82 of July 28, 1945, a report of an interrogation of Lippisch, records: "Concluding, the question of his fuel experiments was touched upon. He felt that at high velocities, solid fuels were more desirable than liquid fuels, the reason being that the solid fuel did not flow out into the velocity stream and, therefore, its burning took place at a predetermined place.

"For a solid fuel to be acceptable it must have good 'gas producing qualities', such as has bituminous coal. The most intense heating among the solid fuels was provided by German normal pine wood 'cooked' in oil or paraffin in pieces 1 x 1 x 1cm."

P.13A RAMM-JÄGER

Lippisch's book Ein Dreieck Fliegt, published in 1976, the year of his death, outlines the development of the P.12/13 up to the point of the Spitzerberg free flight tests and then sums up the project by saying: "Wind tunnel and free flight tests did not show any particularly difficult handling characteristics, so you probably could go ahead to build a flyable and manned model of this design."

There is no mention of what the P.13a's armament might have been and, indeed, no known drawing shows any armament fitted to it whatsoever – in stark contrast to the numerous different armaments suggested for the P.11. Similarly, there is no mention of how its coal grate was to be accessed for refuelling, how the landing skid might have worked or just exactly what the intended mission of this oddly shaped craft was.

When the British asked Lippisch whether the P.13a had been designed as a rammer it was stated that: "The possibilities of using the P.13 as a ramming aircraft had been considered but Dr Lippisch did not think that athodyd propulsion was very suitable for this purpose owing to the risk of pieces of the rammed aircraft entering the intake. This would be avoided with a rocket-propelled rammer."

The P.13 Baubeschreibung produced by the LFW in 1944, probably in October or

early November, undoubtedly with the full knowledge and support of Lippisch, however, makes it abundantly clear that this was not entirely true. The P.13 was indeed a rammer – designed to fly into formations of Allied bombers at high speed and crash into them, cutting them to pieces in mid-air.

The foreword states: "The aircraft presented here is a jet with the task of fighter. The propulsion is by a Lorin engine, not using liquid fuel (gasoline, gas oil, J2 etc.) but with solid fuels (coal). Studies have been carried out on two forms – bulky pieces in a real grate or secondly with pressed coal in plates and hollow cylindrical shapes. Either can be used.

"The engine used allows, for the time being, no self-launch. The launch itself must be carried out with (powder) rockets, a Madelung catapult or similar.

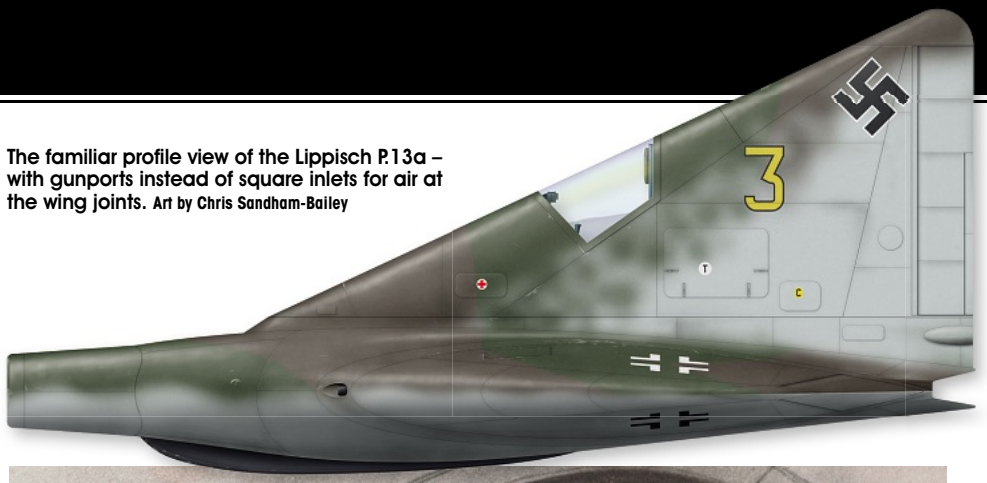
"Due to tactical considerations, among other things, the speed difference of fighters and bombers, preferably when attacking from behind, though thought was given to the installation of brakes (brake parachute, retractable screens similar to dive brakes etc.), and although ample room for weaponry is present, the task of ram fighter has been taken into account – so that the ramming attack will not lead to the loss of the aircraft, thanks to its shape and static structure."

In 'technical information' the Baubeschreibung includes a section on 'means of transport' which states: "When the outer wings are folded, transport of the entire aircraft on a small open car is possible on the Deutsche Reichsbahn."

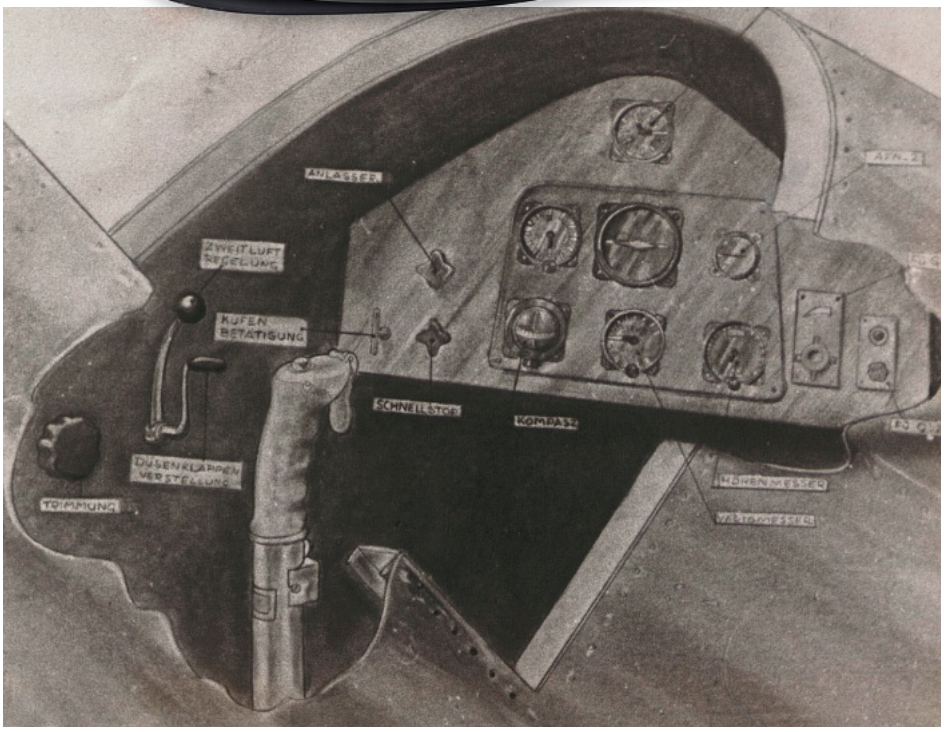
The fuselage section goes into more detail, giving the length of the fuselage as 6m and saying: "The wing attachment fittings (outer wing to wing centre section) are formed so that the outer wings can be folded upwards.

"This is necessary for two reasons. The 'up' position allows access to the engine through the wing centre section, and secondly for loading and offloading onto vehicles during transport."

Details of the structure's reinforced bracing is given, then it states: "The edge cap is constructed as a deflector to avoid rudder damage if possible during ramming. The entire wing leading edge is reinforced with a knife (similar to the Kutonase)."



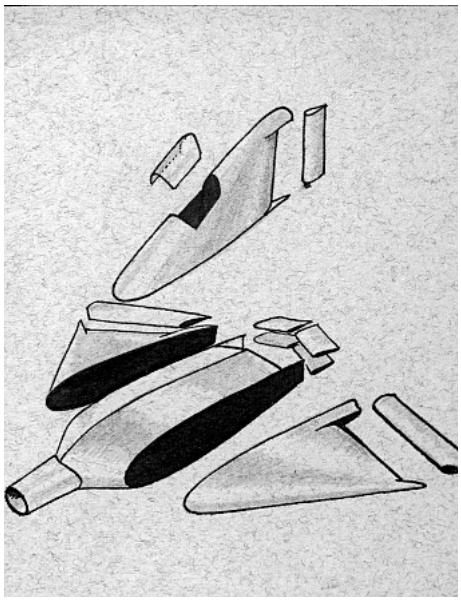
The familiar profile view of the Lippisch P.13a – with gunports instead of square inlets for air at the wing joints. Art by Chris Sandham-Bailey

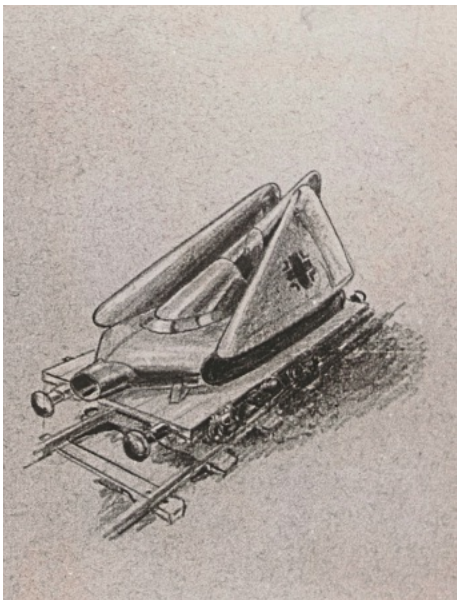


ABOVE: Lippisch's brochure for the P.13 even included details of how the cockpit controls were to be laid out. TNA

The Kutonase was originally developed to cut through the steel cables anchoring barrage balloons. It was a hard steel blade that was fitted right the way along the leading edge of an aircraft's wing – in practice usually a Ju 88 or similar – beneath an aerodynamic fairing of thin flexible metal. This effectively concealed the Kutonase and made the wing fitted with it appear normal.

The fin was "designed just like the wing





BOTTOM LEFT: The cover of Projekt baubeschreibung P13, the brochure which outlines in detail how the type was to be operated in practice. TNA
MIDDLE: A breakdown of how the P.13 was to be constructed, again from the brochure. TNA
BOTTOM RIGHT: Illustration from the P.13 brochure showing how its wings would fold up for transportation on a rail car. The hinged wings also allowed easy access to the coal grate so that the aircraft could be refuelled between missions. TNA

ABOVE: One wind tunnel model of the P.13 was tested with canards on the ramjet's air intake. This would undoubtedly have meant the type had to be used for conventional fighter operations – with guns – rather than as a rammer. Art by Hamza Fouatih Aviation Art

ABOVE: The DM-1 glider built by students to apparently test the aerodynamic qualities of the P.13 shape – with a halfway house between the cockpit-in-fuselage and cockpit-in-fin forms. In reality, Lippisch regarded it as being of little use even before work on it began. via author

and built along similar lines" – presumably meaning that it too housed an aircraft-slicing Kutonase along its length. It was 2.28m high, with this being determined by the need to provide the pilot with good visibility, and was attached to the wing by four fittings, two of them on rockers to allow for expansion of the wing's surface due to intense heating by the ramjet.

The point of connection between the centre section of the aircraft and the outer wings served "as a cooling passage" and when the inner side changed in length due to heating, this was offset by a rocker.

The cockpit itself was "equipped with front and rear walls and is planned to be extremely spacious" and the glazing was designed to be simple to manufacture and distortion-free. The seat and joystick were to be "mounted on the detachable cabin floor" for "production reasons" and the portion of the fin to the front of the cabin was designed to be easily removable for ease of access to the equipment housed beneath it.

Landing the P.13a would have been tricky given the nose-up attitude required. To this end, "a design was chosen where a blade flips open that is rotatable around its front end". This blade-skid with multiple torsion springs was only attached to the fuselage at one end, the other was intended to contact the ground and allow the aircraft to settle using the springs to cushion the impact.

Equipment fitted was to be "in accordance with its task" – horizon, artificial horizon, trip and altimeter, variometer and AFN2, compass, clock, FuG 16 ZY and FuG 25a. There was also an oxygen system installed but no pressure cabin.

P.13A ASSESSED

The minutes of the EHK's meeting on November 21-22, 1944, cryptically state under the heading 'research aircraft': "Emphasis was placed on the athodyd propulsion system of the Lippisch P.13" and Lippisch says in Ein Dreieck Fliegt that "for a short time, series production of this type was planned".

Technical Intelligence report no. I-82 shows the Americans' surprise that the P.13a had been considered for construction: "It appears that Dr Lippisch's work was rather rushed, and that using simplified mathematical relations, he went directly into free flight tests made with scale models.

"His P.13 design incorporated design features, data on which were obtained from Dr Lippisch's model tests. It would therefore appear that some part of the German development work was actually going ahead on a high performance fighter based on what appears to be elementary athodyd design information."

The British assessment of the P.12 and P.13a in German Aircraft: New and Projected Types revealed odd details about both types not mentioned elsewhere, and there is no reason to doubt their accuracy. The P.12 described is that of the wind tunnel model rather than Lippisch's postwar sketch: "An unusual flying-wing design with built-in athodyd using liquid fuel. There is a large intake in the projecting nose and the pilot is seated above the combustion chamber, the cockpit canopy blending with the high single fin.

"The undercarriage comprises a single central wheel with a skid projecting downwards from each wing tip. The wing area is approximately 130sq ft and the aspect ratio 1.33."

When Lippisch drew it for the Americans, he used the presumably later cockpit-in-fuselage arrangement, rather than a cockpit-over-engine layout.

The report states that the P.13 "was originally designed as a two-seater but it later assumed the form shown in the general-arrangement drawing (P.13a)". Sweep-back has been increased until the included angle of the leading-edges is only 60 degrees. The span is 19ft 8in the wing area 215sq ft and the aspect ratio 1.8. A very large fin accommodates the pilot.

"It was originally proposed that the solid fuel in the form of small pieces of brown coal should be carried in a wire mesh container set in the duct at a small angle to the air stream.

"The free flow of air through the lower portion of the duct was thus obstructed and it was hoped to obtain a progressive reaction with the oxygen passing through the fuel burning to CO which in turn would combine with oxygen in the air passing through the upper, unobstructed, portion of the duct to form CO^2. This arrangement proved inefficient and was abandoned.

"A later design called for a circular basket of oval axial section supported within the duct and

positively rotated about its vertical axis at some 60rpm. Combustion is initiated by a gas flame and liquid fuel may be employed to facilitate starting up. Alternatively a more easily combustible material in the form of granules made from coal dust and an oxygen carrier may be distributed around the outside of the charge.

"It is estimated that 1760lb of coal will give an endurance of about 45 minutes. The all-up weight of the P.13 is 5060lb. Initial acceleration to the speed at which the athodyd will function effectively is provided by auxiliary rocket propulsion."

The report also mentions a 'Lippisch supersonic flying wing': "Another Lippisch project intended for supersonic speeds is an athodyd-propelled flying wing bearing a general resemblance to the P.13 but without the large vertical fin. Instead there is a small fin at the trailing edge and the cockpit canopy projects slightly from the wing surface. Sweep-back is even more pronounced than on the P.13."

Given the similarity between this design and the P.12/13, and since they were also intended to be supersonic, and had interchangeable cockpit/fin arrangements similar to this, it seems reasonable to assume that this design belongs to the same overall project.

DM-1 GLIDER

Although no contract had been secured for the P.13a and it is possible that the Baubeschreibung had not even been submitted, it was decided in August-September of 1944 to build a manned, powered experimental version of the P.13a.

Three different fin configurations were to be tested using the P.13a V1 – the cockpit-in-fuselage and small fin arrangement, the same again but with the cockpit more blended into the fin as with the early P.12, and something approaching the cockpit-in-fin layout, but with the cockpit itself still situated within the fuselage and only the canopy in the fin, at its forward end.

It soon became clear, however, that the facilities and the resources necessary to build a powered version of the aircraft were unavailable and it was decided that a wooden glider should be constructed instead.

This held little interest for Lippisch himself, however, since he felt he had already adequately tested the aerodynamics of the aircraft using models. He wrote: "The difficult military situation demanded the drafting of many of the remaining civilian employees for service in the Volkssturm, which was regarded by the powers-that-be as the last line of defence.

"This meant that the aeronautical engineering students also had to join. Only work of the highest priority rating could protect these students from being drafted. Aeronautical students of the Institutes of Technology of Darmstadt and Munich approached me in the hope of obtaining work in connection with the P.13.

"Since the end of the war obviously was imminent anyway, I created the project of a wooden flying glider version of the P.13, which the students were to build under the direction of my assistant, Heinemann, in a hangar of the small airfield of Prien on the Chiemsee.

"The students designated this project D 33 (Darmstadt 33) which was later changed to DM-1 (Darmstadt-Munich 1). We succeeded in obtaining deferment for the students."

LIPPISCH P.13B AND P.15 'DIANA'

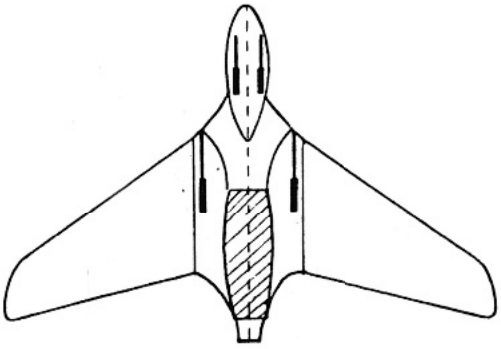
Having lost interest in the P.13a by December 1944, since it was no longer likely to be built and the wooden glider was merely 'busy work' to help some students escape the draft, Lippisch began work on another ramjet design.

The P.13b effectively fitted the P.13a's power plant, albeit with a rotating circular coal grate rather than a fixed rectangular one, into an aircraft that was not dissimilar to that of the P.11, on which much aerodynamic testing had already been carried out.

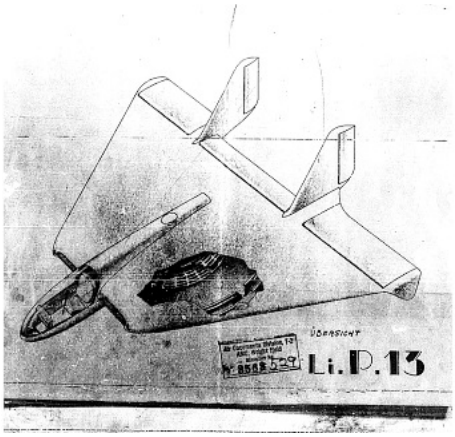
This was just a design study, however, and was never considered for production. Lippisch ended work on it in January 1945. His last project of the war – the P.15 'Diana' – was to be largely built from bits and pieces of other aircraft that were already in production.

The nose was taken directly from the Heinkel He 162 and housed a pair of MK 108 cannon, and there was an additional MK 108 in each wing root. The wings came from the Me 163 but the Ju 248 fuselage, which now housed a HeS 011 turbojet, was wider that than of the rocket fighter so wingspan was slightly increased. There was one air intake in each leading-edge wing root and Bf 109 components were used for the main undercarriage.

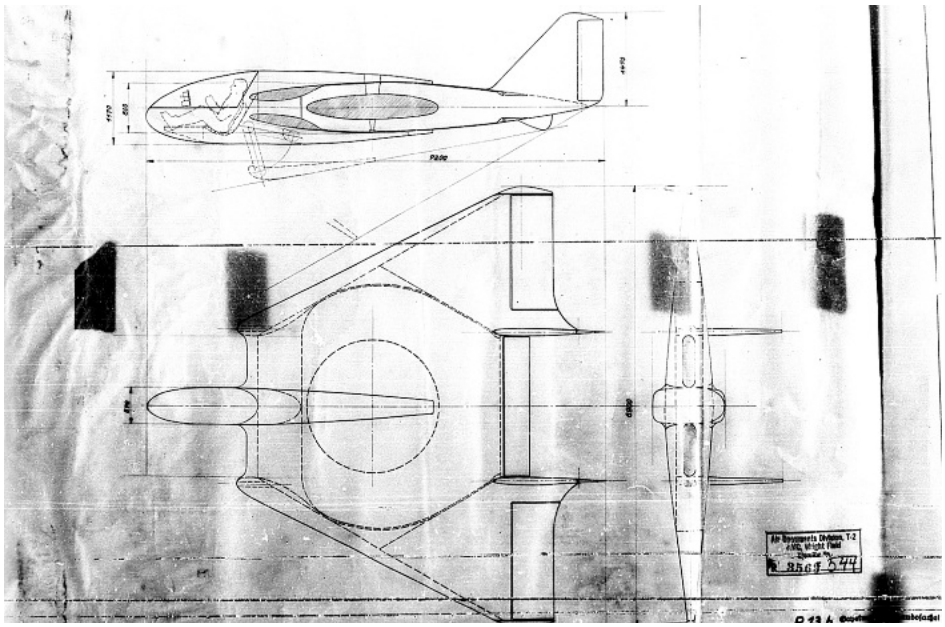
According to Technical Intelligence report no. A-424, wind tunnel tests had begun on the P.15 shortly before the Russians occupied the area around Vienna and Lippisch was forced to evacuate. ●



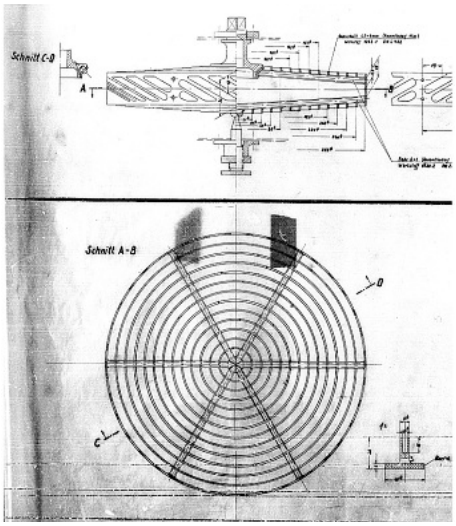
ABOVE: A very basic structural diagram showing the air intakes, powerplant and weaponry of the P.15 'Diana', Lippisch's last project of the war. via author



ABOVE: As the war drew to a close and it became obvious that the P.13a was never going to enter production, Lippisch began work on another design, the P.13b, which combined an aerodynamic form similar to that of the Delta VI with a rotating circular coal grate. via Scott Lowther



ABOVE: Three-view of the Lippisch P.13b. Note multi-section torsion-sprung landing skid – a somewhat sturdier looking version of that intended for the P.13a. via Scott Lowther

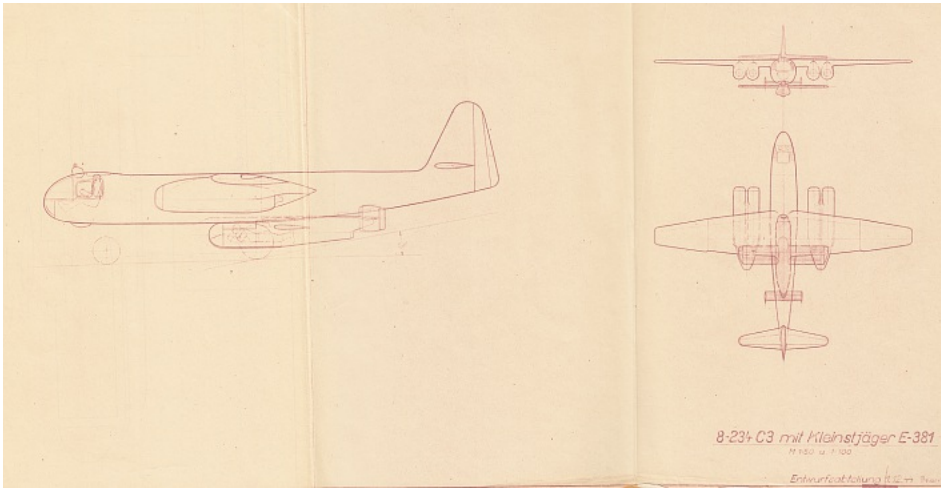


ABOVE: The design of the P.13b's coal grate. via Scott Lowther

The mighty metal m

Arado E.381 Kleinstjäger

While the Verschleissjäger competition dragged on with no clear winner in sight, Arado came up with an independent idea based on its efforts to turn the Ar 234 into a heavy fighter. Why not attach a small rocket-propelled mini fighter to the underside of every Ar 234C fighter?



ABOVE: The Arado E.381 Kleinstjäger would have been carried into battle slung beneath a four-engined Ar 234C-3, as shown in this contemporary German drawing. The pilots of each aircraft could communicate via telephone and warm air was circulated to the 'midget' during transit and before separation. GDC

While other firms focused their efforts on making supremely lightweight ground-launched bomber interceptors filled with rocket fuel and heavy ordnance, Arado took an entirely different approach.

A report produced in December 1944 by designers only identified as Brauer and Lindecke details a well armoured rocket-powered air-launched Kleinstjäger or 'midget fighter'.

The authors begin by outlining their thinking behind the design: "Design description of a midget fighter: The nearer a fighter can approach his adversary, the higher the probability that he will bring him down.

"However, if the adversary is heavily armed, it may be impossible for the attacker to come within effective combat range; unless, indeed, the fighter has complete armour protection making him invulnerable to enemy fire.

"Such complete armour protection for a standard piston-engined or jet-propelled fighter is, however, impracticable: firstly because it is impossible to give complete armour protection to the propulsion plant, and secondly because the weight of the necessary armour would impossibly reduce performance."

A rocket engine could be given complete protection, however, and the problem of getting this heavy little aircraft aloft could be solved by simply carrying it up under another, bigger, aircraft.

"The fighter can be so designed that it is brought by a parent aircraft within sight of the adversary, is then released from its carrier, and then, driven by its rocket unit, attacks and brings down its opponent, subsequently landing in a long glide," the report says.

"The following possibilities and advantages are obtained: the weight of compete armour protection can be carried i.e. attack within shortest effective range is possible; range and endurance correspond to those of a standard fighter; remote control by the parent aircraft to within sight of the opponent is possible.

"After breaking away, the parent aircraft can join the combat as an escort fighter; the fighter is not an expendable unit; the cost of production and equipment is the least possible; in addition to complete armour protection, its small size makes it a very difficult target for an adversary."

The report then states that on this basis a "device" has been designed for use with the proposed Arado Ar 234C heavy fighter. Fastened to the big jet's belly, the 'midget' would generate sufficient lift to 'carry' most of its own weight, with the pilot lying prone in its nose. The midget's pilot would be given instructions on when to change his machine's trim via intercom from the Ar 234's pilot.

According to the report: "The arrangement is also used to prevent abrupt change of trim on release of the suspended aircraft. The release is effected by the pilot of the suspended fighter. No provision is made for release by the pilot of the carrier, firstly to avoid the necessity for modifications in the carrier and secondly because this is not, in essence, a jettisonable load capable of being dumped in an emergency.

"The structural modifications to the parent aircraft are therefore confined to: attachment of the three suspension slips, extension of the intercom system to the suspension point and extension of the heating circuit to the suspension point."

In combat, the parent aircraft would fly to within sight of an enemy bomber formation, as far as possible above it. The midget's pilot, seeing the bombers, would then activate the release mechanism and put his machine into a glide before activating its rocket engine. At top speed, he would then be travelling some 124mph faster than the bombers.

idget

The midget's designers enthused that their machine was "so protected by armour that it has every chance of penetrating the enemy fire barrage without serious damage, and opening fire at closest range from its MK 108 guns. The available 45 rounds of 30mm ammunition should suffice for two attacks".

Once all the ammo was gone, or the guns had seized up as was often the case with the MK 108, although it doesn't say so in the report, "the rocket unit is stopped, to have an available reserve of fuel on landing, and the fighter glides down. A landing parachute brake is provided to enable a belly landing on a relatively confined space, a carefully designed shock-absorber skid and springing of the pilot's support mitigating the landing shock".

The pilot would have a "considerable gliding range" with which to select a suitable landing site, ideally somewhere near a main road or airfield so that the midget could be quickly reached by ground crew and towed away.

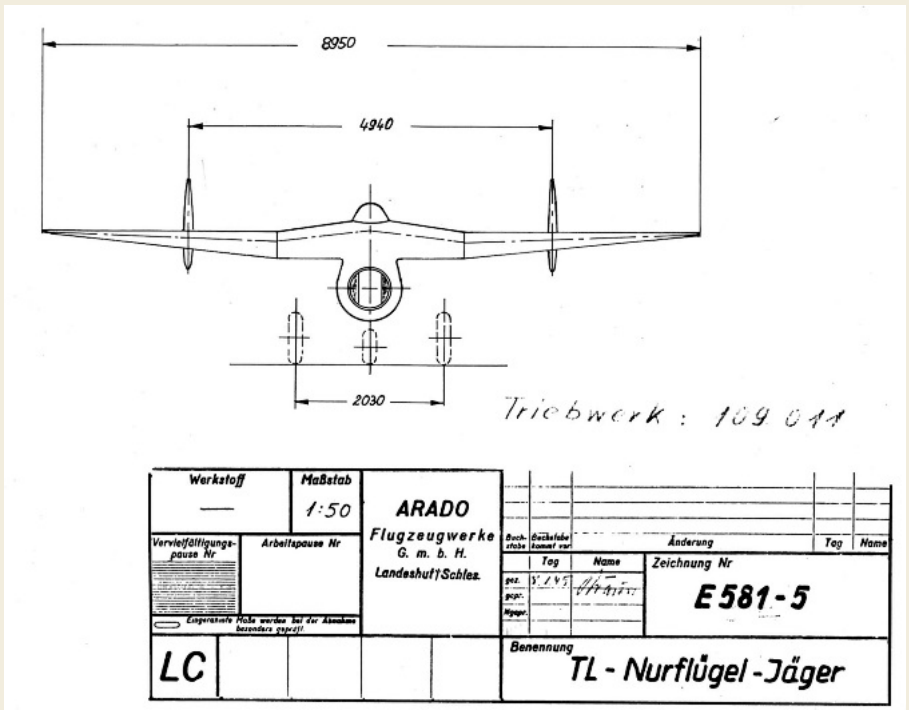
After this brief assault, the pilot of the carrier aircraft would have more work to do: "Meanwhile, the parent aircraft will be in a position to attack the enemy in the capacity of an escort fighter. If the operational situation permits, it will endeavour to spot the landing place of its small fighter before returning to base, where one or more further midget fighters should be available for further operational use.

"Collection and return of the landed small fighters is a matter for the ground services. The ideal organisation is approximately as follows: Each two parent aircraft are served by one special motor truck, on which two small fighters can be accommodated.

"These trucks are directed to the landing points, either determined by the parent aircraft, or reported by telephone. At the landing point, the small fighter is disassembled into: wing unit, fuselage and tail unit. These components are so designed that their individual weight can be handled manually without difficulty."

Concern is expressed in the report that pilots might struggle to fly an aircraft while lying prone, so it is suggested that "midget fighters of the simplest wooden construction",

ABOVE: Arado believed the E.381 Kleinstjäger's key selling point would be its hefty armour plated protection for the pilot, the engine and the fuel.
Art by Chris Sandham-Bailey



ARADO'S FLYING WING JET FIGHTER

Another oddity from Arado, the firm behind the most conventional of Germany's wartime jets, was the E.581 fighter.

If it weren't for the fact that the E.581-4 version appears in the German Aircraft: New and Projected Types document, it might well have been dismissed as a figment of some postwar enthusiast's over-active imagination.

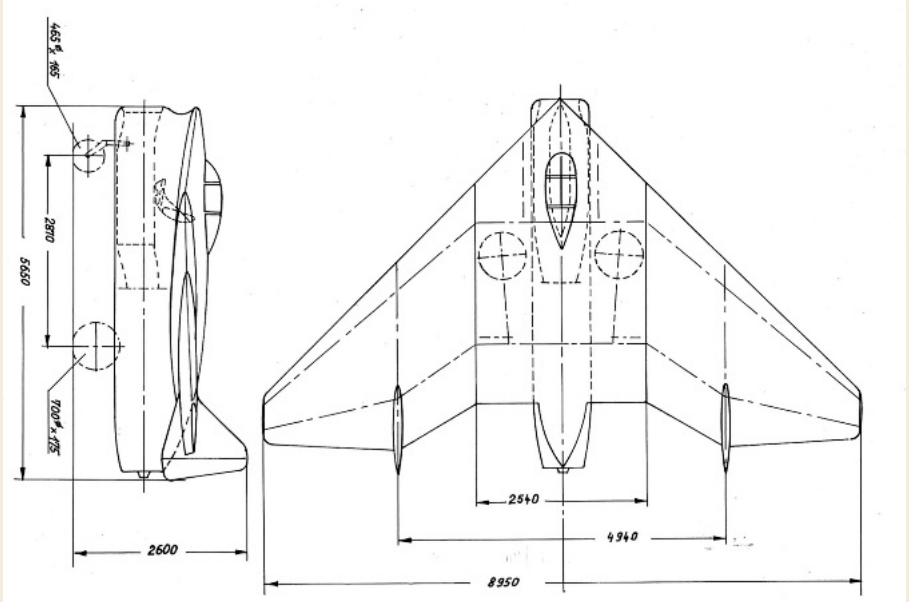
The British intelligence report's note on the type is terse: "Arado E.581-4 single-jet fighter – a high-wing tailless single-seater with a single HeS 011 jet unit mounted in the fuselage. The main wheels of the tricycle undercarriage retract forward into the wing, upon which are set the twin fins and rudders. Span: 29.3ft. Length: 18.4ft."

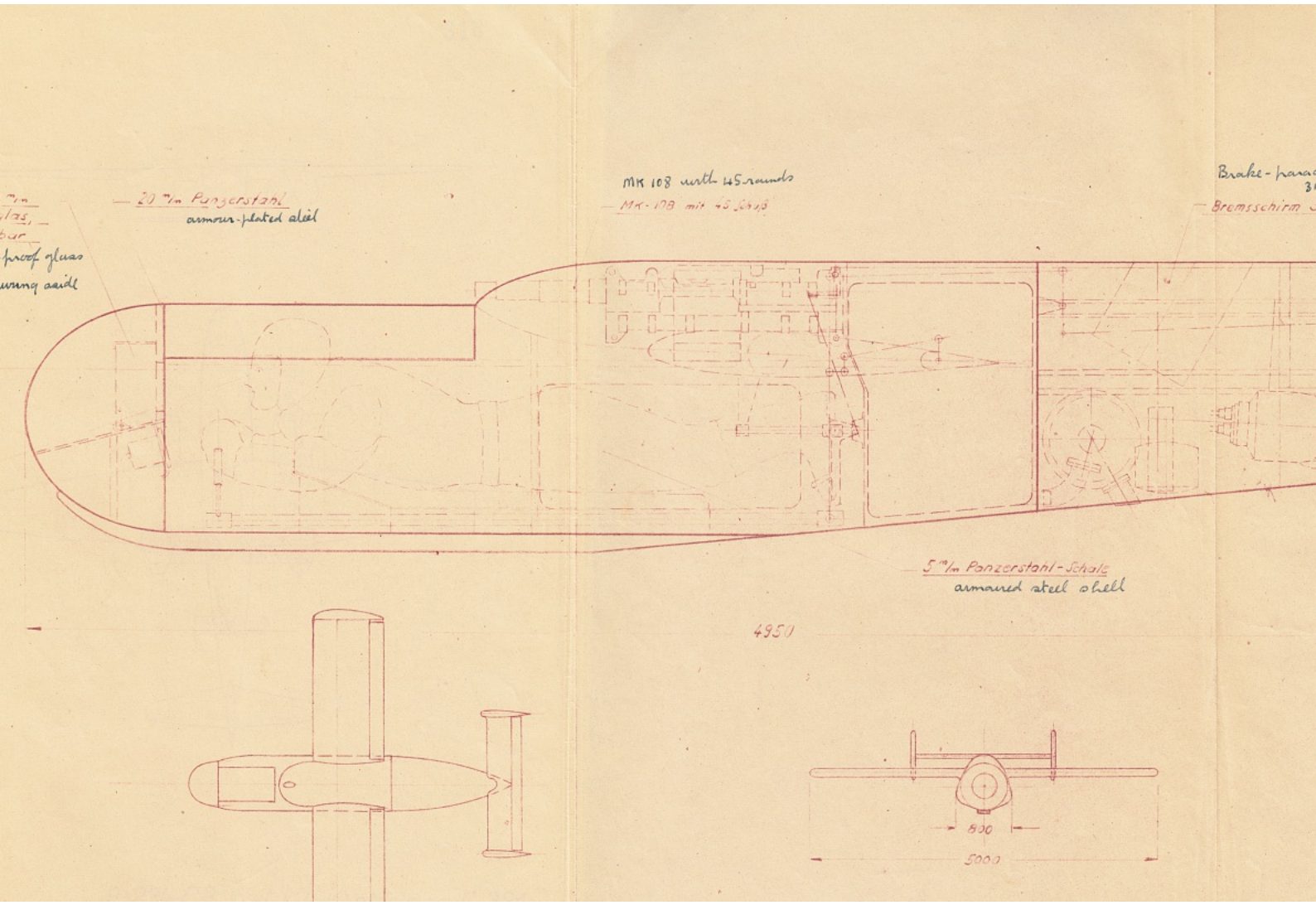
Details of a purported E.581-5 were published in a German magazine during the 1970s. This made mention of a 'special container' through which the type's range would be extended but little other additional information was offered.

It has been suggested that the E.581 was being readied as a competitor in the 1-TL-Jäger competition but it does not appear in reports of meetings where the other competitors are discussed and can therefore be regarded as an Arado design study.

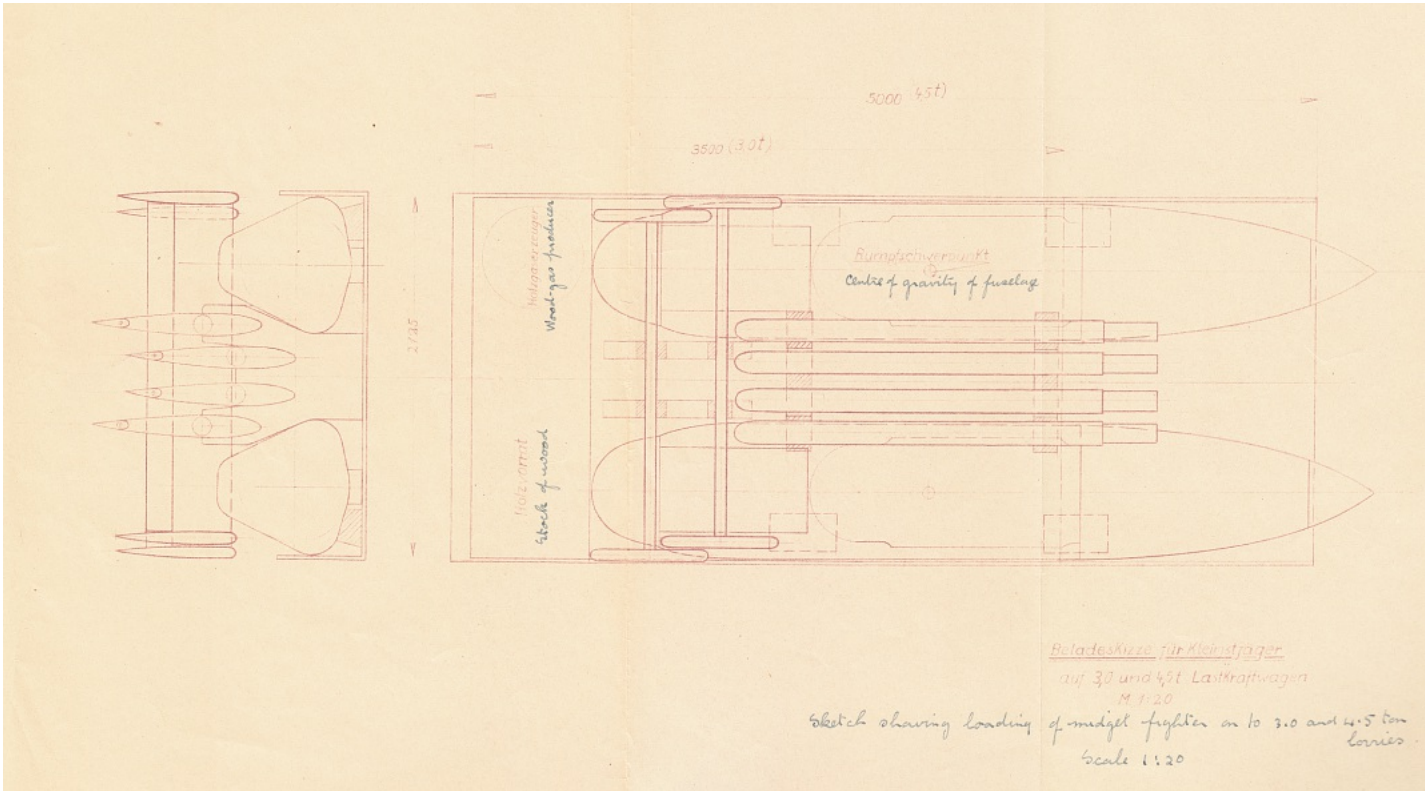
Most of the company's jet fighter work involved variants of the multi-engine Ar 234 and given the general shift in emphasis towards smaller single-engine types it was probably thought, at some stage, that some preliminary work should be done on such an aircraft if Arado was to have any hope of competing in the future.

It seems that the first of Arado's two large twin-turbojet night fighter designs, thought to have been given the project number E.583, may well have owed something to the E.581, however.

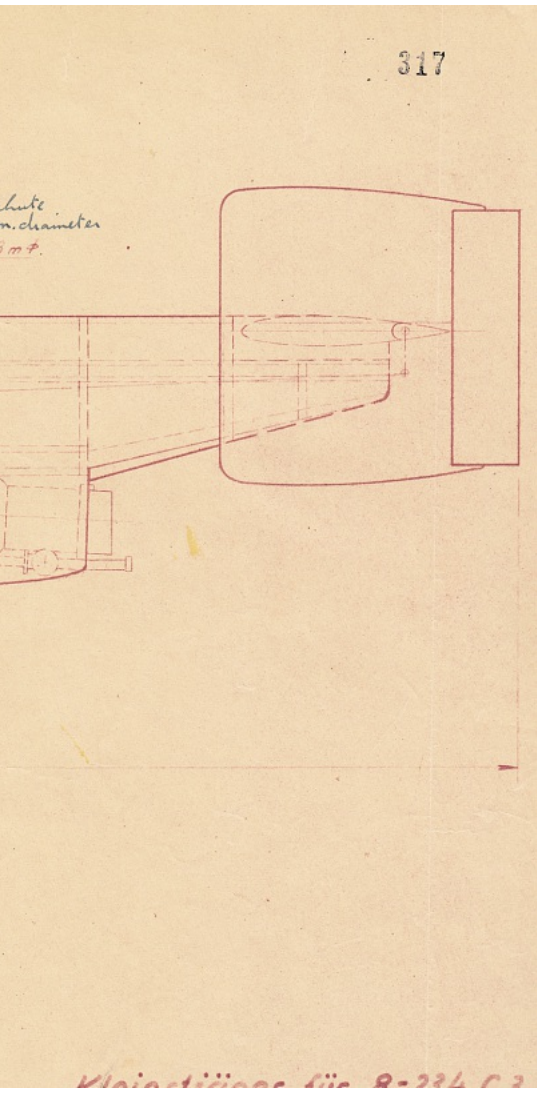




ABOVE:The compact dimensions of the 'midget' are illustrated in this Arado drawing, with handwritten English annotations added after its capture by the Allies. GDC



ABOVE: Once released, a 'midget' would never manage to return to its home base under its own power. It was proposed, therefore, that trucks would be made ready to collect it from wherever it had landed. This drawing shows how two aircraft could be neatly fitted onto a three ton or five ton lorry with the detached wings and tail sections positioned vertically between and above the fuselages. GDC



launched using a winch, could be provided for training purposes. There was also the small matter of actually getting into the midget.

"Since the entry hatch is on top of the fuselage, the pilot must take his place before the machine is loaded up," the report says. "It has been suggested to provide a side-door entry, but this would excessively complicate the design layout, since with the undercarriage lowered, a simple side door will be insufficient. Mockups to elucidate this point are already being tested. This long 'prone standby' is undesirable but is unavoidable. Loading up is effected by a standard bomb-loading truck."

As an aircraft designed to destroy bombers, it was important to Arado that the midget should be able to actually get close enough to those bombers to open fire on them. Every defensive machine gun on both Boeing's B-17 Flying Fortress and Consolidated's B-24 Liberator was an M2 Browning machine gun firing .50 cal ammunition – 12.7mm.

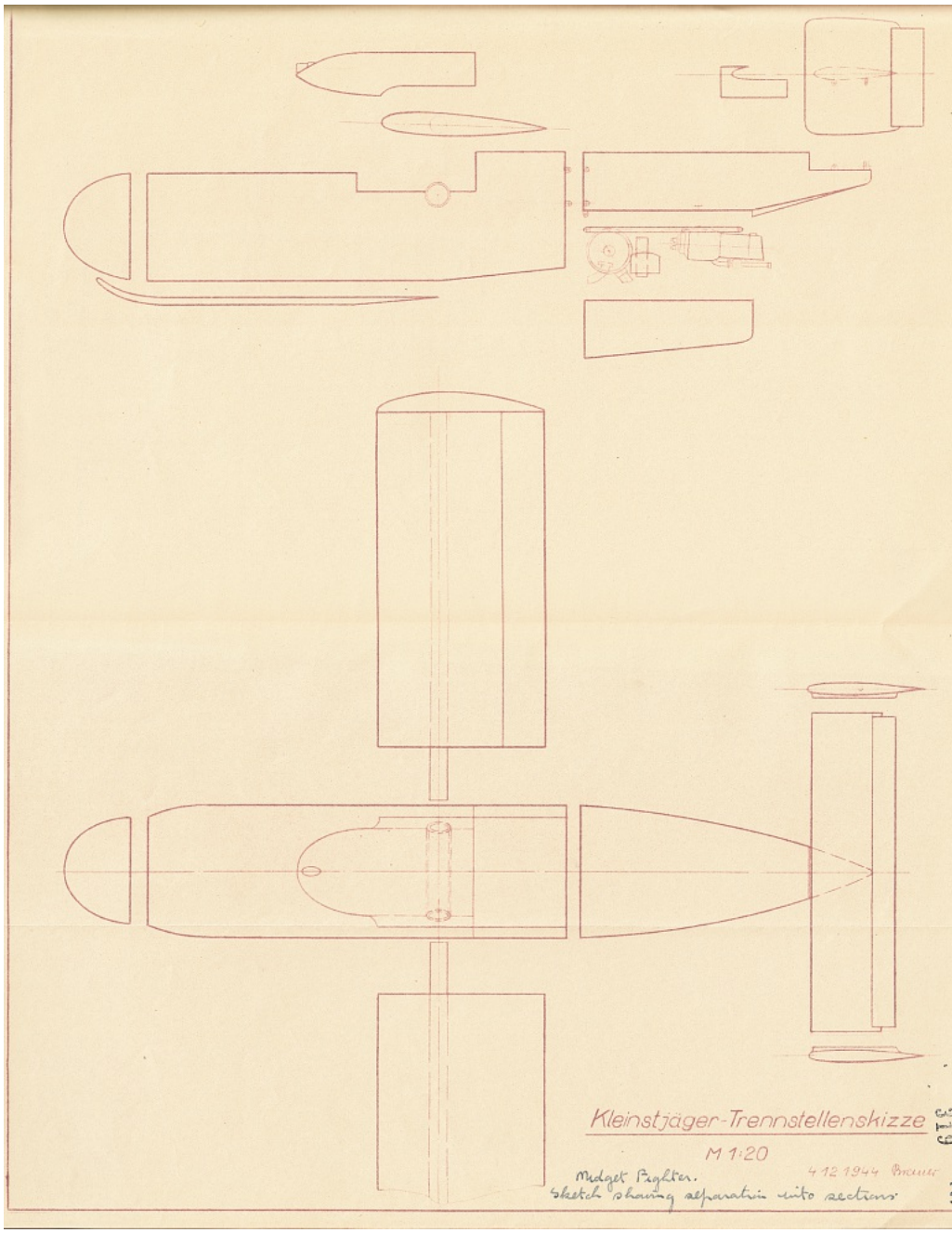
The midget fighter report states: "The armour protection is designed proof against 13mm projectiles. The arrangement is as follows: the fuselage nose is formed by a cylindrical tube of 5mm armour, having a pear-shaped cross-section.

"In front, the fuselage is closed by a combination of armour plating and bulletproof glass, combining protection with high visibility. If the glass is broken, with consequent loss of visibility, the pilot is enabled to remove the damaged pane, and thus have free visibility. The whole is enclosed in a streamlined plexiglass fairing.

"The armoured tube is entered by a front upper entry hatch closed by an armoured cover plate. This hatch is arranged to be jettisonable in flight. The pilot is provided with a carefully padded couch, to which the bearings and clips of the control rods are attached. The pilot's head is supported by an adjustable head-rest.

"At the side by the pilot's legs, two C-Stoff containers are fitted inside the armour protection. Behind the feet and inside the armoured tube, separated from the pilot by a bulkhead, is the T-Stoff tank. Thus, complete armour protection is afforded for the pilot, the controls, and the fuel.

"For protection against aerial damage, the wings and tail surfaces are provided with a filling of porous material. The wing spar is a thick-walled steel tube, ensuring protection of the carrying member owing to the small likelihood of direct hits. The aircraft skin is of sheet steel. The tail surfaces are constructed in essentially the same manner as the wings. The ammunition, carried in the port wing, is specially protected in addition by an armoured strip."



ABOVE: Another key feature of the E.381 Kleinstjäger was the ease with which it could be taken to pieces for transport. GDC

In terms of equipment, the pilot got a standard reflector sight with which to aim his gun (or, the report suggests "a rocket projectile can be provided instead"), handwheel control for elevator and ailerons, pedal controls for rudder, adjustable to pilot's size, and levers for depressing ailerons at take-off and landing.

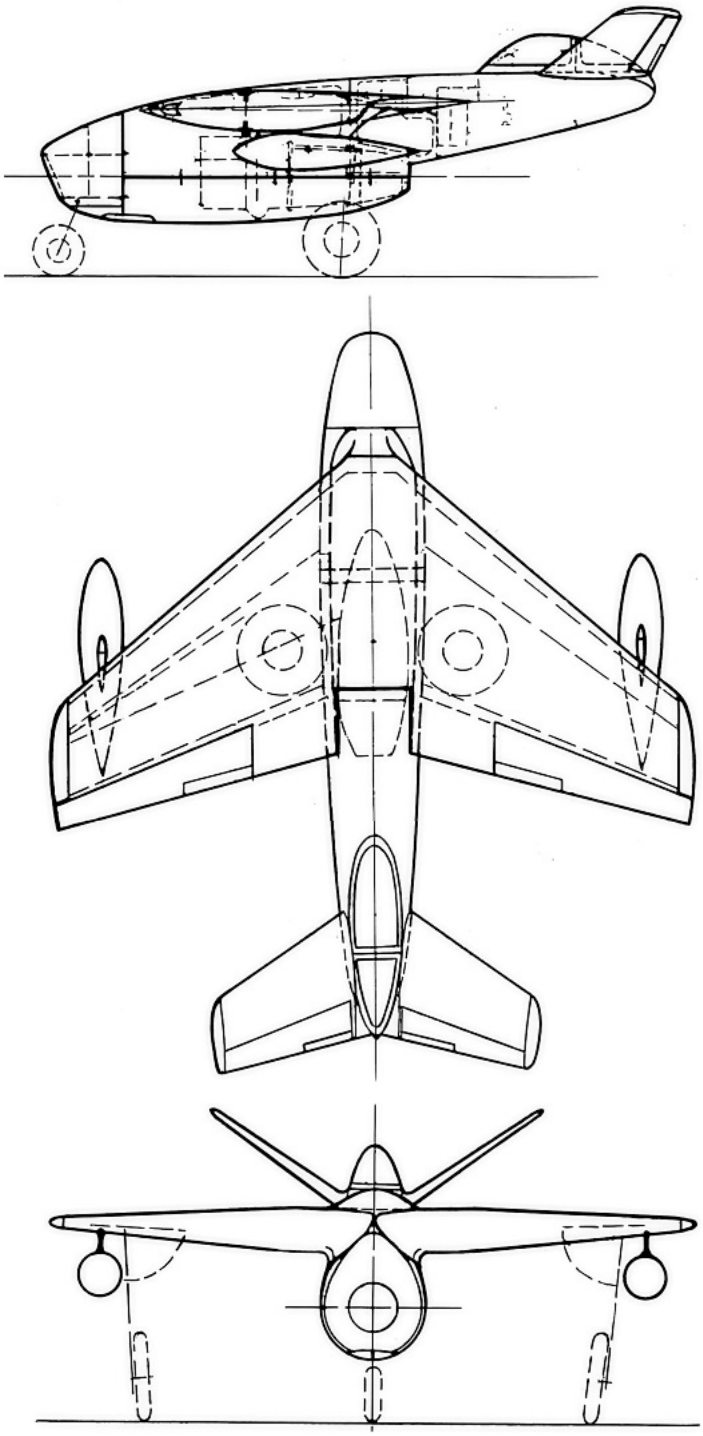
There was also the intercom system and hot air heating from the parent aircraft. Flight control instruments were to be an airspeed recorder, altimeter and turn and bank indicator. For engine monitoring, there were two pressure gauges and one temperature gauge. The pilot got a parachute, oxygen apparatus and a safety belt.

Arado's E.381 Kleinstjäger was apparently submitted to the RLM but the type is not mentioned at later meetings of the EHK and must therefore have been rejected at an early stage – possibly on the grounds that other rocket interceptor projects were much further along in development and the Ar 234Cs did not yet exist to carry the E.381 aloft in any case. ●

Unknown!

Postwar 'discoveries', misinterpretations and mysteries

The end of the war saw tons of 'secret projects' documents burned, captured or left to blow around in empty hangars. Some companies' documents were almost completely lost, others were scattered. After the war some of these seemingly reappeared, but are they genuine 'projects' or the product of overactive postwar imaginations?



ABOVE: Few contemporary drawings of the P.1106 are known to survive and they have only lately come to light. In the 1970s, readers had to make do with drawings such as this, which has some of the type's correct features but much, like the undercarriage arrangement, which is based on pure guesswork.

The aviation magazines published immediately after the Second World War and on into the Fifties, Sixties and Seventies wrote article after article about the 'amazing discoveries' made by the Allies in capturing the drawing and design offices of the German aircraft manufacturers.

While the British and American companies had apparently contented themselves with straightforward and sensible designs for jet fighters, the Germans had seemingly exercised a hitherto unheard of degree of creativity in their proposals for new rocket and jet powered types.

And there was a wealth of material to publish and republish – but once everything that could be readily found had been written about in as much detail as the documents available allowed, there remained an unsated appetite for fresh discoveries.

This was at a time when many of the designers, engineers and other staff who had worked for those famous German companies in their original forms were still alive. The magazine editors therefore did their best to track down anyone who might have fresh material – perhaps something the British and American intelligence operatives had missed during their search for every last shred of German technical data and knowhow.

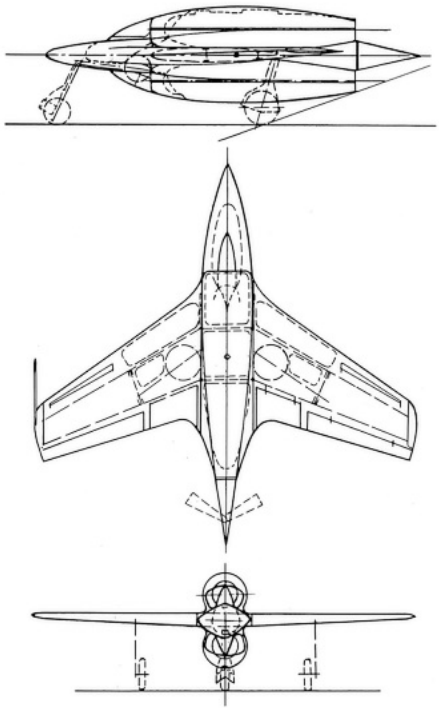
The response appears to have been underwhelming to say the least, but some documents were apparently forthcoming. Fantastic designs began to appear in popular magazines that the authors of the German Aircraft: New and Projected Types report, with its 174 designs, had apparently missed. Some were relatively conventional, others outstripped even the "entirely novel" Focke-Wulf Triebflügeljäger in their outlandishness.

MESSERSCHMITT 'ANIMAL NAMES' TYPES

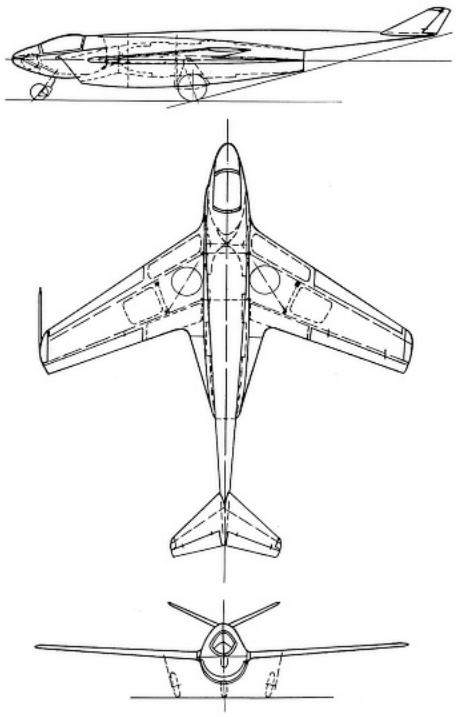
Some of the earliest examples of the 'new discovery' phenomenon appeared in German magazine Luftfahrt International Nr. 18 of November-December 1976. This series of magazines, begun in January 1974 by publisher Karl R Pawlas, who died in 2014 aged 88, has long been revered as the gold standard of German secret projects research – issue one has an introduction written by Focke-Wulf chief designer Kurt Tank himself.

Issue 18 included an article headed 'Little-known German aircraft projects from the time of the Second World War' which states: "The list of Messerschmitt aircraft designs produced during the Second World War has, despite diligent research, still a considerable number of gaps.

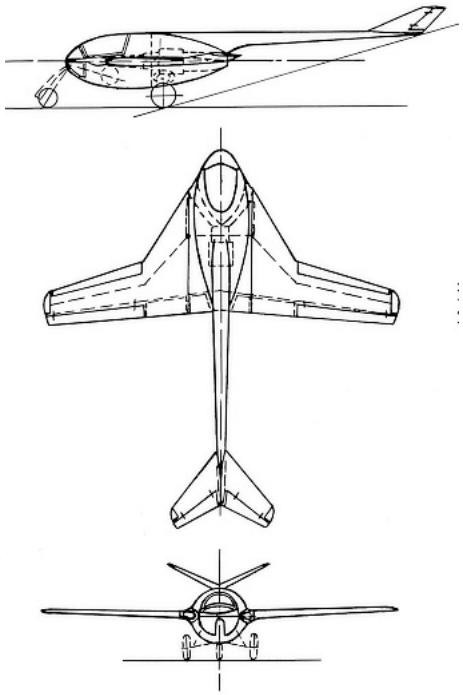
"From a former Messerschmitt employee, the author has been provided with some documents that were previously based on technical data and three-views that throw a little more light on the P.1106, P.1107 and P.1108 projects and some probably completely unknown designs.



ABOVE: The Messerschmitt Schwalbe. Willy Messerschmitt's firm seldom used names for its aircraft and never used them entirely in place of numbers. The wings of this design are reminiscent of the Me 163 but the undercarriage layout is out of character, the cockpit looks odd and the engine arrangement is decidedly strange.



ABOVE: Bearing a marked similarity to the 'Schwalbe', the Messerschmitt Wespe has an oddly shaped canopy and turbojet. Its undercarriage is unfamiliar at a time when most German designs incorporated existing undercarriage components from other types to reduce costs and speed up production.



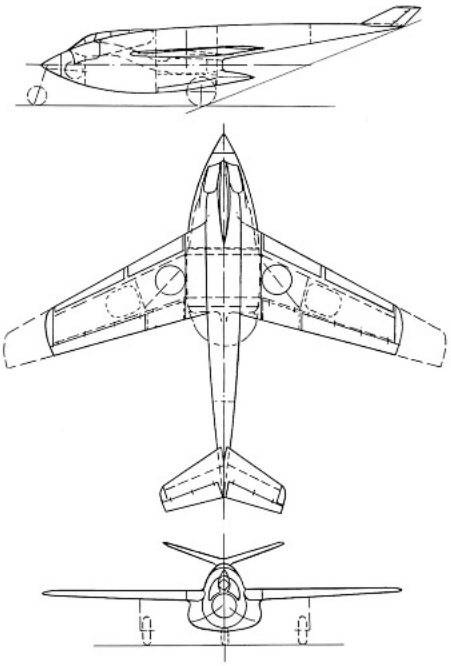
ABOVE: If any of the Messerschmitt 'animal names' types ought to be genuine it's this one. The Libelle's tadpole-like form has a certain elegance and its otherworldly oddness makes it a true novelty. It bears very little similarity to any known Messerschmitt type, however.

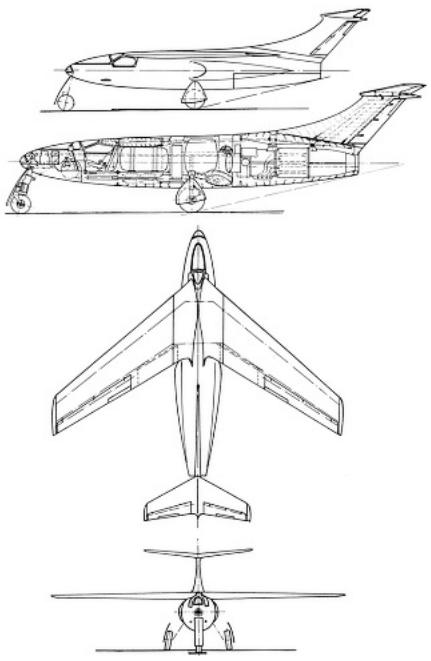
"It remains unclear, however, whether work on these designs, which were apparently given animal names, was completed before the end of the war by Messerschmitt or after the surrender.

"Other designs, for which some data, three-view drawings and a detailed longitudinal section are present, lack any type designation."

It is evident that the author, Pawlas himself, has misgivings about the designs. To suggest that a design may have been "completed after the surrender" is to imply that it was either produced by a Messerschmitt designer working for the Allies in the year or two immediately after the war, as some did, or that it was completed... even later.

Indeed, Pawlas usually reproduced the original company documents and photographs in his magazine if he had them, to demonstrate the authenticity of his work. Not in this case.





ABOVE LEFT: The Wildgans is another peculiar design supposedly created by Messerschmitt which surfaced during the 1970s. ABOVE RIGHT: While it does have a certain P.1111 or P.1112 look to it, there are features of the apparently unnamed Messerschmitt heavy fighter, presented here, which are anachronistic – particularly the curving T-tail.

The P.1106 featured bears more than a passing resemblance to that seen in other verifiable sources. The P.1108 flying wing presented is accurate, based on original drawings available elsewhere, and the P.1107 is not pictured. Then comes the decided odd-looking 'Schwalbe' heavy fighter with two stacked turbojets and wings strongly reminiscent of those fitted to the Me 163.

Despite the design being identified as Messerschmitt P.1079/18 by Dieter Herwig in his Luftwaffe Secret Projects: Ground Attack and Special Purpose Aircraft, it seems likely that the 'Schwalbe' – which no one had apparently seen before 1974 – is the product of someone's desire to draw something Messerschmitt-like.

The same is true of the single-jet engine 'Wespe', the 'Libelle' light fighter, the bomber-transporter 'Wildgans' and another unnamed heavy fighter, though some of these do not even resemble anything likely to have been worked on during the war.

As Herwig's translator Ted Oliver carefully notes: "Unusual for Messerschmitt project drawings is that none of the dotted-outline turbojets in each of the drawings matches with the contours of any turbojets that were under development by BMW, Daimler-Benz, Heinkel-Hirth, Junkers and Porsche (which would be logical to expect), nor do the thrust figures quoted for them correspond to the known turbojet variants."

There are certainly gaps in the Messerschmitt project list – relatively little is known about the P.1107 and P.1109. To make matters worse, by the time the Americans reached Messerschmitt's Oberammergau project design facility on April 29, 1945, the offices had already been abandoned by Messerschmitt personnel and then ransacked ▶

by escaped slaves. It is sometimes suggested that these pillagers carried off fistfuls of secret project designs – possible but unlikely.

BLOHM & VOSS AE 607 AND MGRP

Blohm & Voss was another company well known for experimenting with unusual designs. When the firm's Hamburg design offices were captured by the British on May 3, 1945, a huge stack of design documents, drawings and brochures were taken, along with Blohm & Voss personnel.

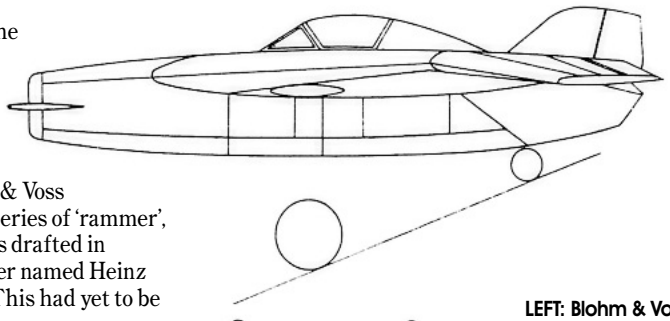
This accounts for why the British author of German Aircraft: New and Projected Types is able to include 36 B&V designs, including a whole host of advanced fighter types. Many of the original documents and brochures pertaining to Blohm & Voss designs still exist in British archives. It is odd, then, that British intelligence should have been entirely ignorant of what was presented as the Ae 607 many years later.

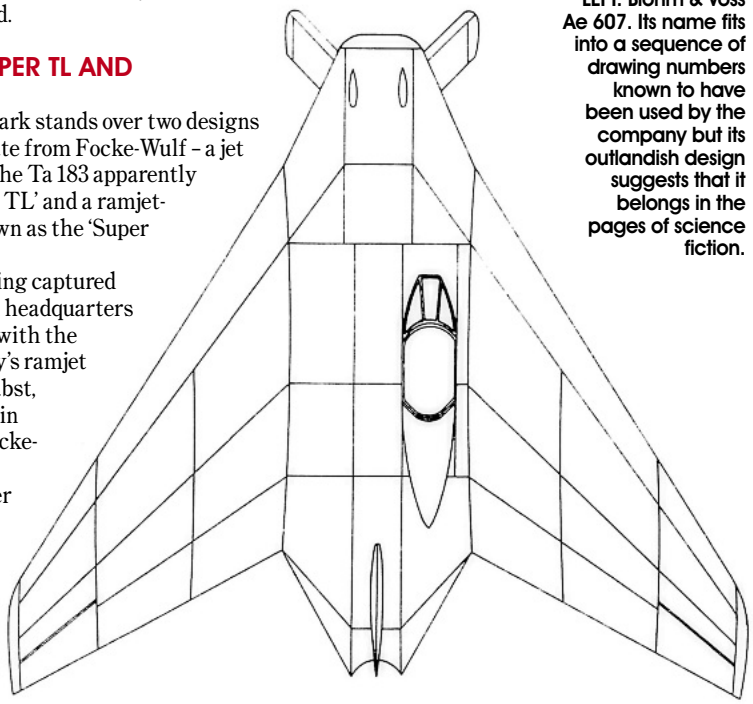
This strange, flat-looking aircraft with its offset cockpit, little canards near the intake for its engine, and a bizarre undercarriage arrangement, seems to embody just about every negative cliché ever directed at the work of Blohm & Voss.

There is evidence to suggest that 'Ae XXX' was a series of Blohm & Voss drawing numbers – with Ae 613/1, Ae 615 and Ae 620/1 all being slightly sketchy designs for wing sections of the P.215 – but no original drawing of Ae 607 has yet been published.

The same can be said of the Blohm & Voss MGRP 'Manually Guided Rocket Projectile'. B&V was a world leader in guided rocket projectiles but whether the company ever dallied seriously with the idea of putting a man inside one of its missiles is unknown. Had it done so, it seems likely that the Allies would have commented on it at the time. Instead, it goes unmentioned.

It has been speculated, in recent times, that the design has nothing to do with Blohm & Voss and is in fact just one of a series of 'rammer', ramjet and rocket concepts drafted in August 1944 by an engineer named Heinz or possibly Karl Stöckel. This had yet to be conclusively verified.





LEFT: Blohm & Voss Ae 607. Its name fits into a sequence of drawing numbers known to have been used by the company but its outlandish design suggests that it belongs in the pages of science fiction.

FOCKE-WULF SUPER TL AND SUPER LORIN

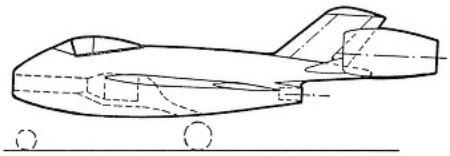
Another question mark stands over two designs purported to originate from Focke-Wulf – a jet similar in layout to the Ta 183 apparently known as the 'Super TL' and a ramjet-powered design known as the 'Super Lorin'.

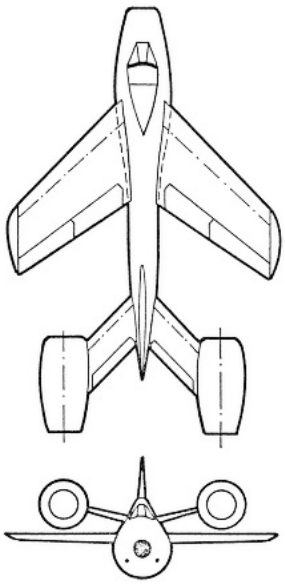
The British, having captured Focke-Wulf's design headquarters at Bad Eilsen along with the head of the company's ramjet programme, Otto Pabst, examined this work in detail. The other Focke-Wulf ramjet designs – the Strahlrohrjäger and Triebflügel Flugzeug – are extensively discussed. Yet neither the Super Lorin nor the Super TL is referred to.

Examining the designs themselves, the Super TL is composed of three drawings that do not match up – the engine intake in profile is far larger than the forward view allows. Similarly, the Ted Oliver rule applies to the engine – as it appears in the fuselage it is a smooth cylinder – lacking the telltale lumps and bumps that would identify it as a particular real powerplant, perhaps a Jumo 004 or HeS 011.

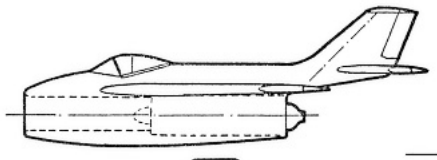
The Super Lorin bears a resemblance to the Ta 183, but with the Strahlrohrjäger's ramjet pods. It similarly lacks any 'engine detail'.

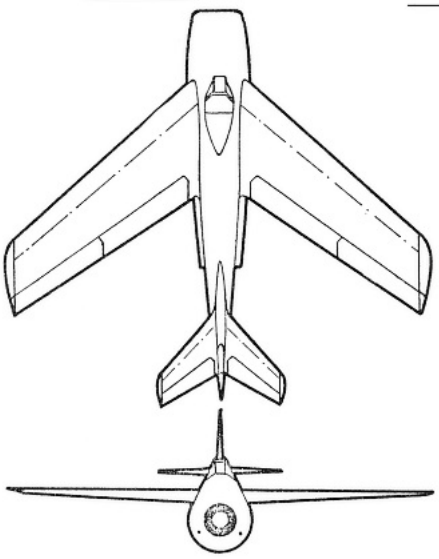
Having said all this, the Super Lorin, at least, has a lengthy pedigree. It was appearing in magazines as early as the late 1950s, pictured alongside the Focke-Wulf Strahlrohrjäger.





ABOVE: Focke-Wulf Super Lorin. This combined turbojet/ramjet design might conceivably have been designed by Focke-Wulf but no mention is made of it in any contemporary documents relating to Fw ramjet projects.

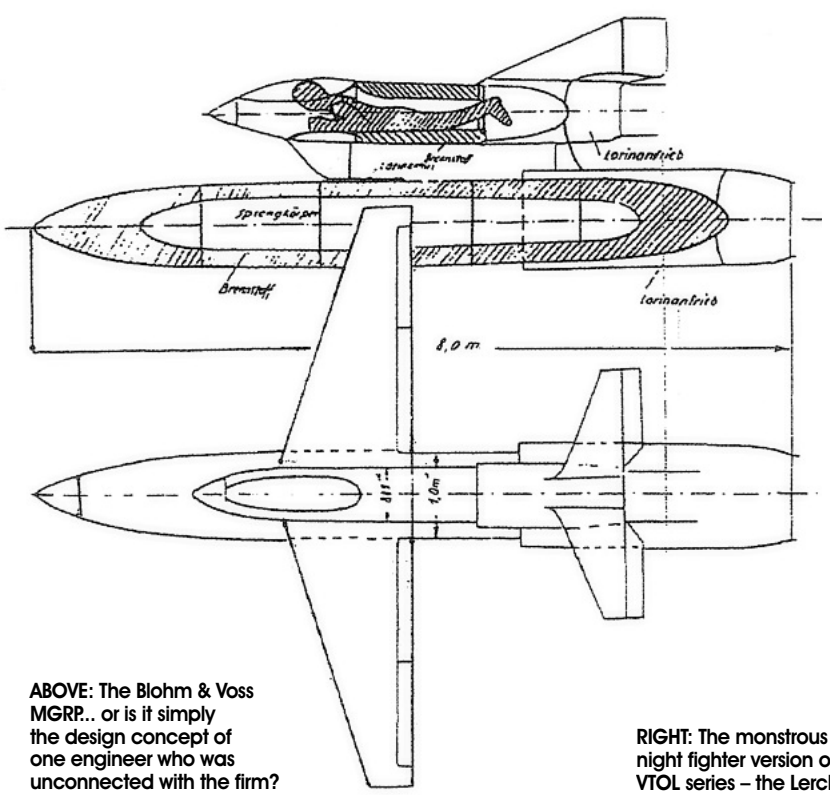




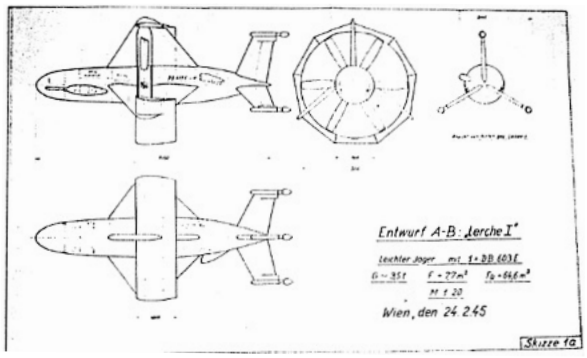
ABOVE: Usually presented alongside the Super Lorin, the Super TL looks similar to the Focke-Wulf Kurzbaubeschreibung Nr. 30 aircraft entered for the 1-TL-Jäger competition but more simplistic and without any drawing number or even a 'does what it says on the tin' Focke-Wulf project name.

HEINKEL LERCHE AND WESPE

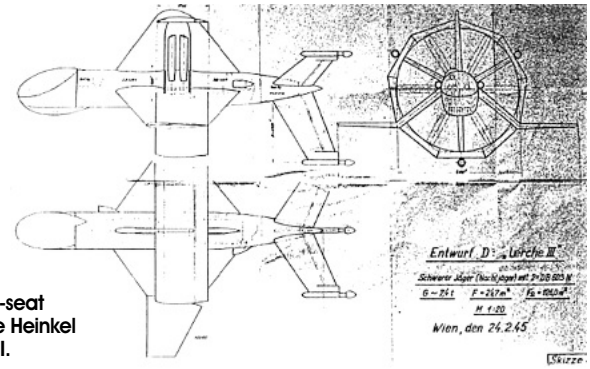
Since the 1930s, Heinkel had developed substantial design expertise and worked on some cutting edge projects. Nothing quite compared to the work it undertook in designing the He 162 and preparing it for both production and ongoing development though.



ABOVE: The Blohm & Voss MGRP.. or is it simply the design concept of one engineer who was unconnected with the firm?



ABOVE: The sketchy first image in the sequence of six Heinkel VTOL design drawings, the single-prop Lerche I.



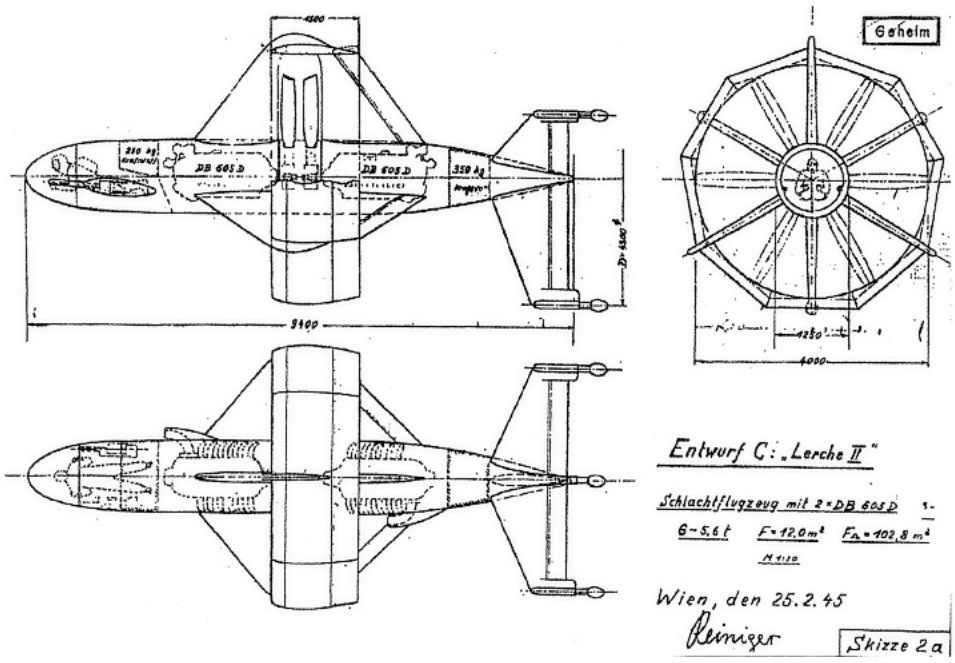
RIGHT: The monstrous two-seat night fighter version of the Heinkel VTOL series – the Lerche III.

As the war neared its end, Heinkel was working on different configurations for its P.1079 night fighter and on an airframe, designated the P.1080, to accommodate the ramjet engines that it had recently been given data on. The former was a wide-ranging study that took in flying wings – an area in which Heinkel had no prior experience – and the latter involved the incorporation of new technology with all its attendant challenges and calculations.

Still, the firm found time to work on potential developments of the He 162 – versions powered by Argus pulse jets and with different wing arrangements. Did Heinkel's designers, in addition to all this, find time to investigate propeller-driven vertical take-off types too?

Six drawings, three of them signed by 'Reiniger' and three more which appear to be part of the same set, have emerged within the last 30-40 years showing remarkable designs for vertical take-off interceptors.

Skizze 1a (Sketch 1a) shows a machine labelled Entwurf A-B: 'Lerche I' (Design A-B: 'Skylark I'), a light fighter, Skizze 2a shows Entwurf C: 'Lerche II', an attack aircraft, and Skizze 3a shows Entwurf D: 'Lerche III', a huge night fighter version. The drawings are marked Wien (Vienna) and dated February 25, 1945. In the A-C designs, the pilot lies prone in the nose between a pair of what are almost certainly MK 108 cannon. Landing gear consists of castors on the tips of three tail fins.



ABOVE: Lerche II. Apparently a Heinkel design, although it doesn't say so, and the designer's name is unusually prominent.

Skizze 4 shows an aircraft of loosely similar layout labelled Entwurf E: 'Wespe' (Wasp). This is a 'Leichter Jäger' (light fighter) with a single Daimler-Benz PTL-021 turboprop engine providing the power to a single large centrally-mounted propeller. Like the Lerche III, the Wespe has wings as well – a stubby set protruding from the fan cowling structure – and a bubble canopy under which the pilot would no doubt have been seated, rather than prone.

Unsigned, Skizze 4 shares its date and location with Skizze 1-3. The final sketch, Skizze 4d, again signed by Reiniger, seems to rather crudely ape a Focke-Wulf drawing which shows the Triebflügel Flugzeug at a similarly dynamic angle. The date this time is March 10, 1945, with no location.

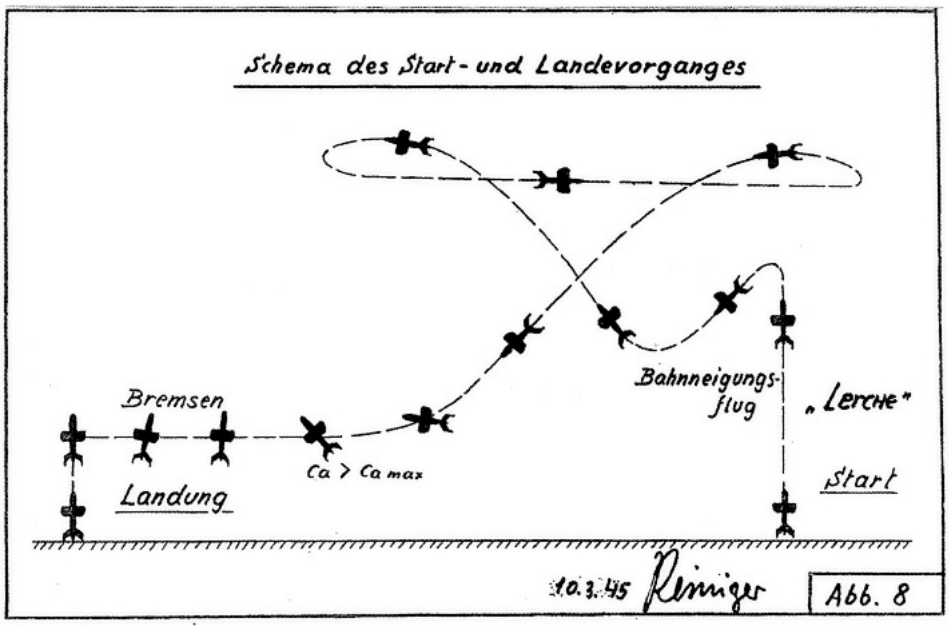
The fourth drawing shows how the Lerche was intended to take off and land.

The Lerche I-III and Wespe were unknown to the British in the immediate postwar period and probably the Americans and Russians too. When they did appear, they were identified as Heinkel designs, though no Heinkel markings appear on any of the drawings.

In Aeronautical Research in Germany: From Lilienthal Until Today, authors Ernst Heinrich Hirschel, Horst Prem and Gero Madelung identify the source of these drawings as a Heinkel report entitled Vorschläge zur Geschwindigkeitssteigerung durch Verwendung eines Luftschrauben-Mantelringes als Tragflügel unter Ausnutzung des Senkrechtstarts, dated March 8, 1945, and written by K Reiniger.

This is believed to be Heinkel employee Karl Reiniger.

There are two problems with this source. First, two of the drawings are dated March 10, 1945, and second, it seems odd that the Allies were not aware of Reiniger's work in the immediate aftermath of the Second World War. The intelligence agencies of the British and Americans, the French and the Russians, give no indication that they knew about it – when ▶



ABOVE: Dated later than some of the other drawings, this diagram showing how the Lerche would launch clearly belongs to the same 'set'.

they knew about and wrote about practically everything else.

The earliest published source on the Lerche and Wespe that this author could find appeared in 1984. Later sources, particularly Steve Coates writing in 2002, identify more designs in the sequence – Entwurf A, B and D – but the drawings presented appear to have benefitted from a degree of tidying up and nothing of the remainder of the report appears ever to have been published anywhere.

Karl Reiniger appears to have gone to work for Daimler-Benz in Germany after the war, producing advanced VTOL designs which owe absolutely nothing to the Lerche and Wespe during the late 1950s. Perhaps he kept the only copy of the report to himself before finally releasing it years later? The full story of these intriguing designs has yet to be told.

HENSCHEL PROJECTS

If Heinkel's late-war projects are sketchy, then those of Berlin-based Henschel are positively opaque. The company spent much of the latter part of the war designing innovative tail-first canard-type aircraft for a variety of roles but predominantly bombers – probably.

Unfortunately for anyone in the West wanting to learn about the company's projects, the Russians apparently captured the Henschel facility before any other Allied forces could get to it and before it could be evacuated away from them – a rare occurrence.

As a result, almost nothing is known today about Henschel's projects. Almost everything that is known comes from the documents of other companies. For example, the Hs 132 ground-attack and dive-bomber was widely discussed outside the company and documents relating to it were circulated to the RLM and beyond.

It is therefore known that the small turbojet-powered aircraft, similar in layout to the He 162 but with the pilot lying prone in a heavily glazed nose, had wooden wings but was otherwise made entirely of metal. Its structure was specially designed to withstand the enormous forces that would act upon it during a fast dive onto its target – up to 12G.

There were three different versions envisioned – the Hs 132A, B and C. The Hs 132A was powered by a BMW 003 and carried either one 250kg bomb or one 500kg bomb but no defensive armament. The Hs 132B had a Jumo 004, two MG 151 guns and the same bomb options as the 'A'. The Hs 132C was powered by a HeS 011 and carried the same payload as the 'B' but with the added option of carrying a single 1000kg bomb instead of a 250kg or 500kg.

Six prototypes were to be built, of which one was 90% complete when the war ended.

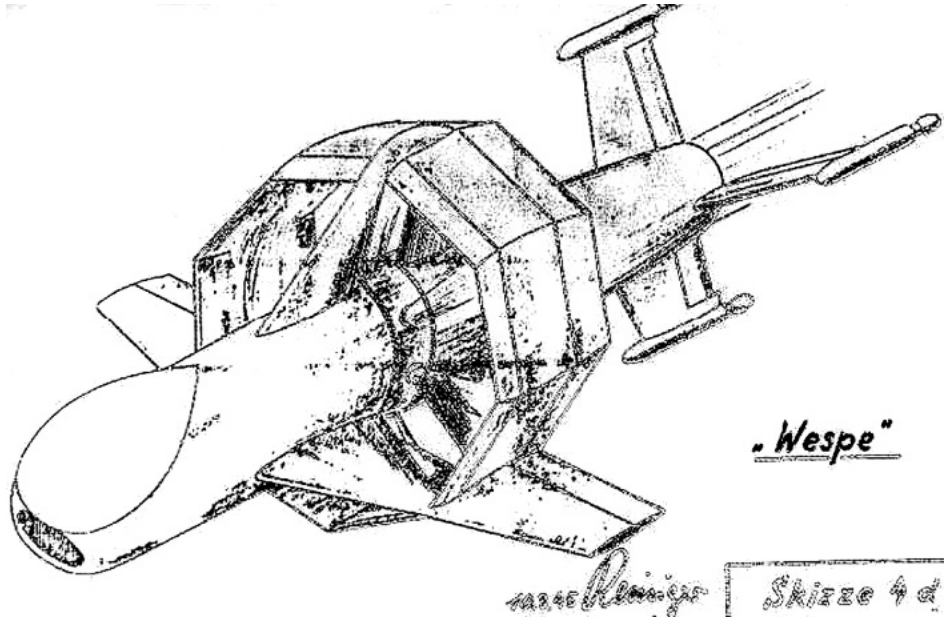
Also reliably documented in German Aircraft: New and Projected Types is the Henschel P 122 high-altitude jet bomber. This large two-man aircraft had a wingspan of 70ft and had a range of 1240 miles at 55,700ft. Propulsive power was supplied by a pair of BMW 018 turbojets.

Henschel projects detailed by other authors, for which no original sources are cited, include the P 75, P 87, P 135 and PJ 600/67. Considering the level of detail presented, it would be easy to imagine that at least some documentary evidence exists for these types.

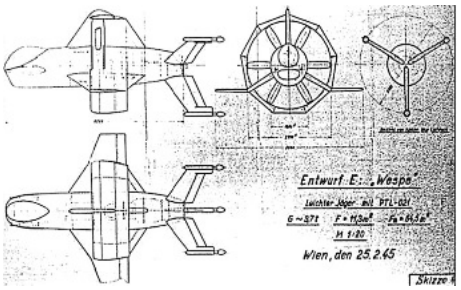
The 'PJ 600/67' is a good example. One author wrote that it was a single-seater ground-attack aircraft designed under the supervision of engineer Friedrich Nicolaus in 1941/42. It was to be primarily deployed against shipping.

It was to carry 2000kg bombs and would be fitted with four 30mm MK 108 cannon or two MG 151 "which would be mounted below the aircraft in a special compartment, the 'Waffen-Wanne'." The PJ 600/67 had a wingspan of 12.1m, a length of 14.8m and a height of 2.35m. The author continues: "The Henschel PJ 600/67 would be equipped with two Argus As pulsejet 109-014 engines, each producing a thrust of 410kg or two Argus As 400 pulsejets with a thrust of 500kg. The construction was of the 'canard' type. As with the 400, the device would reach a speed of 810kph and would be dropped from an aircraft or launched into the air by a catapult. The latter is doubtful since it is doubtful that a man could withstand the 19G generated during the launch of the pulsejet powered V1.

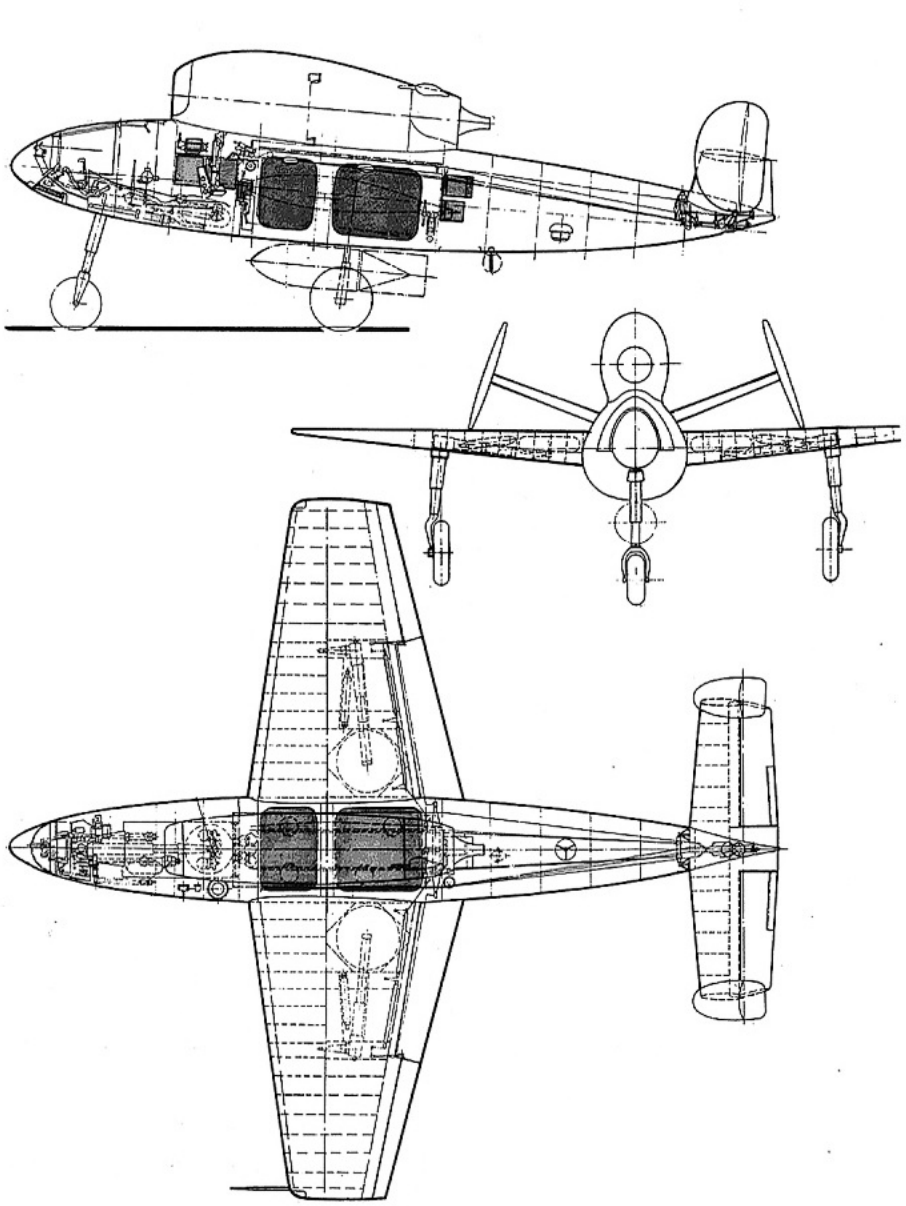
"After several tests with scale models a prototype was set up in a wind tunnel. However, the project was stopped by the RLM. The Soviets captured the drawings and then

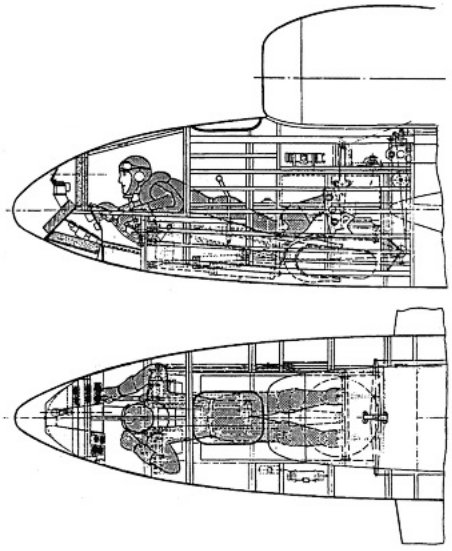


ABOVE: The familiar signature reappears for this three-quarter view of the Wespe.

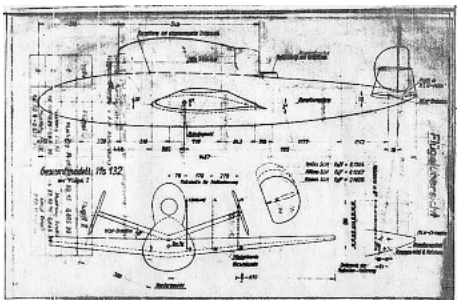


ABOVE: Seemingly another drawings from 'Reiniger', though his name is absent from it. The Wespe design is seemingly more advanced than that of the Lerche II but the drawing itself appears more basic.



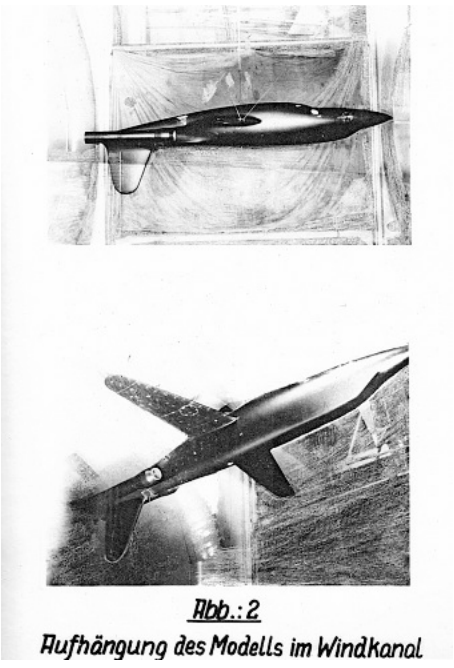


ABOVE: The pilot of the Hs 132 would have been prone in the cockpit – this position having been specifically chosen to allow his body to better cope with the forces generated during a dive bombing attack. But is this a real Henschel drawing or a later work of imagination?

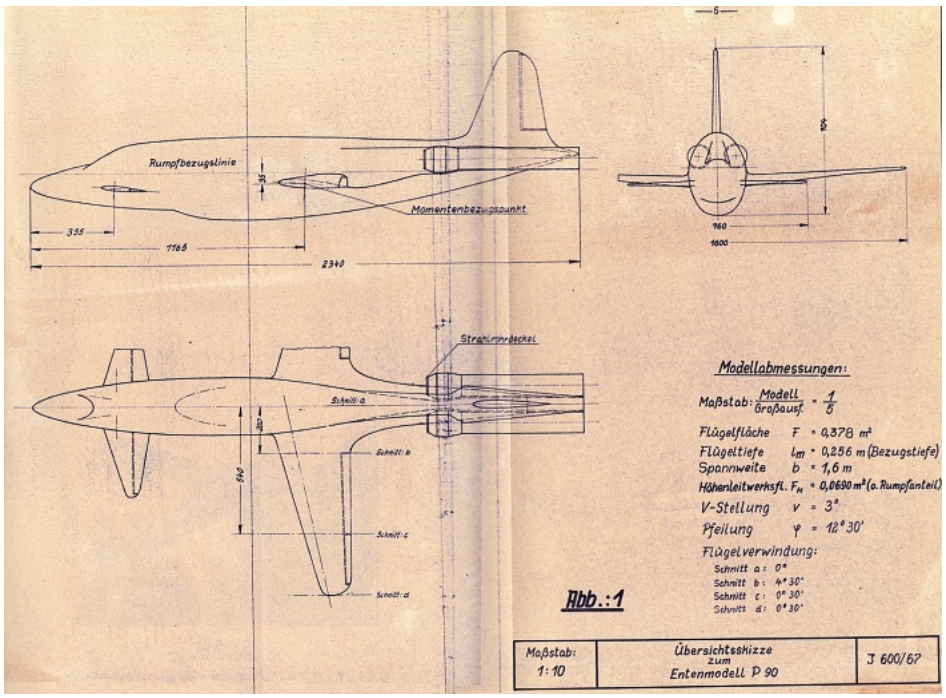


ABOVE: Many Henschel projects survive as little more than drawings of wind tunnel models that were tested by external contractors. At least this gives a good idea of the shape the project was intended to take.

LEFT: This detailed drawing of the Henschel Hs 132 appears genuine – and purports to originate in Russia – but there's no way to be certain that it is not simply a clever fake.



ABOVE: The wind tunnel model of Henschel's P 90 as it was tested – suspended upside down. GDC



ABOVE: Wrongly identified for years, very little is known about the Henschel P 90. GDC ▶

built the aircraft, testing it atop a Pe-2 carrier aircraft to assess its airworthiness. It proved to be so unstable, however, that the project was ended."

In fact, the name PJ 600/67 seems to have arisen from a misinterpretation of a wind tunnel test report produced for Henschel by its subcontractor, the Deutsche Versuchsanstalt für Luftfahrt (DVL). This document, dated November 24, 1943, relates details of how, following a successful series of tests on the canard-type Henschel P 87 project, a new design, the P 90, had been subjected to the same regime.

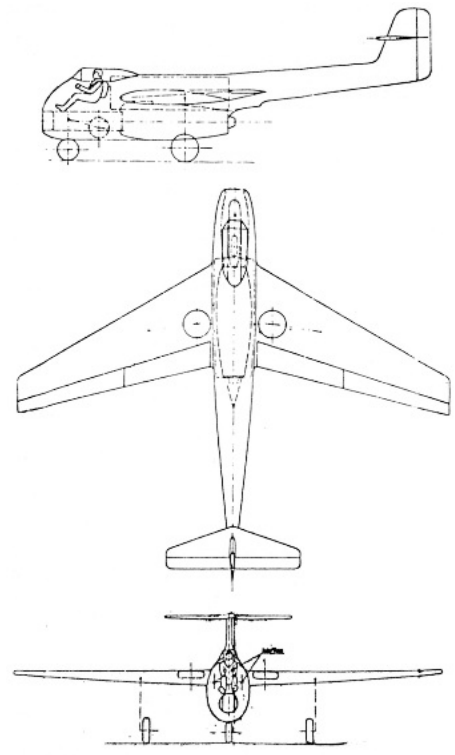
The accompanying drawing is clearly that of the 'PJ 600/67' yet is clearly marked 'Entenmodell P 90' or 'canard-model P 90'. It is the same drawing reproduced elsewhere in a degraded level of detail. The label 'J 600/67' is present in the bottom corner of the drawing. On the following page, the P 90 is further discussed and at the bottom of the page is printed 'konto J 600/68' or 'account J 600/68'.

It seems likely, therefore, that 'J 600/67' was an internal DVL reference number, relating to Henschel as its customer – nothing to do with the design itself. No details are given as to the size, equipment or function of the P 90, just its aerodynamic qualities.

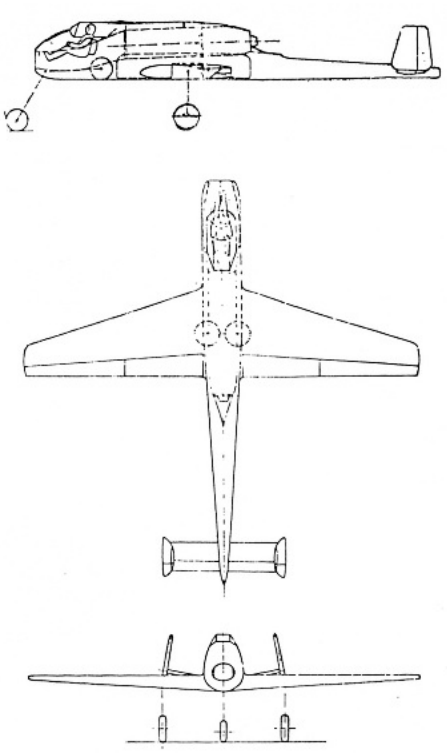
On this basis, it would seem that some confusion has arisen about the P 90. Since 'PJ 600/67' would not have appeared in relation to the P 90 beyond the DVL report, the other details about the history and purpose of the 'PJ 600/67' would appear to have no basis in fact.

We are left, instead, with another Henschel project about which almost nothing is known for certain, except its true name.

Without original drawings for the P 75, P 87 and P 135, they may well fall into the same category.



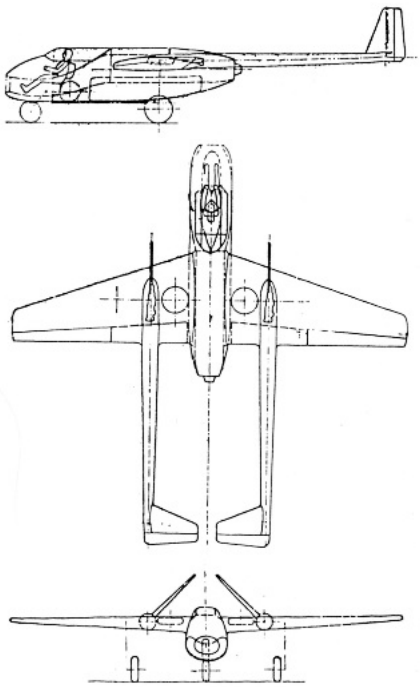
ABOVE: BMW Strahljäger III with twin boom tail and double MK 103 cannon armament.



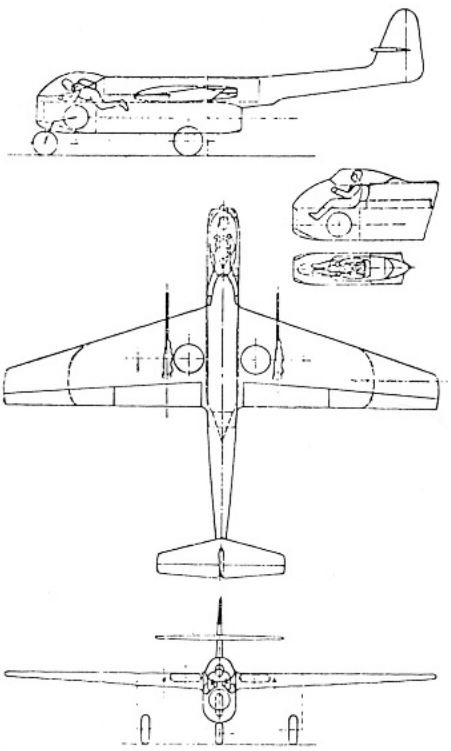
ABOVE: The BMW Strahljäger I design. It was to be powered by a single dorsally-mounted BMW 003.

BMW SINGLE JET PROJECTS

As an aero engine manufacturer, BMW spent a lot of time working with its customers – the aircraft companies. In 1944, its most eagerly anticipated product was the BMW 003 engine. This had been on the drawing board in one form or another since 1939 and BMW had made numerous promises about when it would be ready which it had been unable to keep.



ABOVE: BMW's Strahljäger IV was larger than the other three designs since it had to accommodate the enormous BMW 018 engine. The tail design in the forward view does not match that of the side view.



ABOVE: The second BMW Strahljäger design had a tall but narrow cockpit in which the pilot would either be seated or prone. The long cannon in the wings are probably MK 103s.

Now though, it finally looked like the 003 really was ready to enter series production. The only problem was, it was now outperformed by most of its rivals. BMW therefore seems to set out on a bit of a promotional campaign in an attempt to drum up some interest in the 003 and its bigger brother, the BMW 018.

This took the form of some helpful suggestions for single-engine airframe types that might suit it – generally known today as BMW Projekts I, II, III and IV. These are basic, and in one particular case, inaccurate designs even by their own standards but they are of some interest.

It has previously been stated that these were the work of a Dr Huber, an employee of BMW subsidiary EZS, who wrote them up in EZS report No. 58.

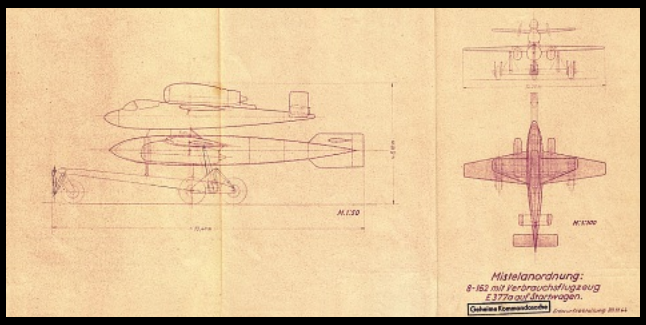
CIOS report XXVI-30 gives "notes on BMW personalities" and says of Huber: "Deputy chief of project department. Project reports and other important documents found in his safe."

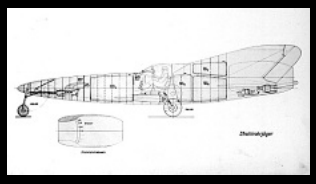
At the end of the report is a list of "documents brought back to Air Ministry from BMW". File 1 is said to contain "project department reports by Kappus and Huber". Report 58 is missing from the list but among reports such as No. 62 – "calculations of performance of He 162 with 1 x 003R" and No. 55 "the athodyd as an artillery weapon" is No. 53 dated August 8 "possibilities of further developments in fighters".

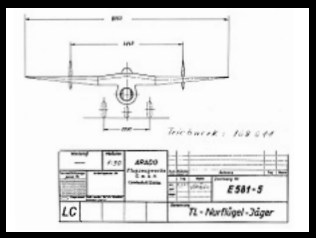
It may be that someone somewhere else found report No. 58, but it also seems entirely possibly that report No. 53 featured the four fighter designs. Unfortunately, the original no longer resides with the old Air Ministry files, though it is listed in the catalogue, and must be presumed lost. ●

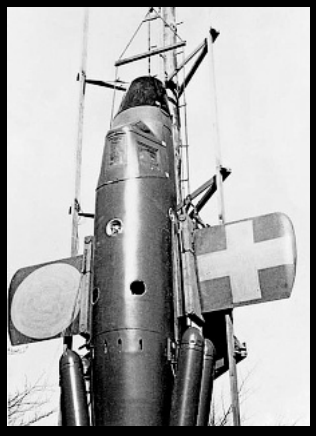
LUFTWAFFE

Secret Jets of the Third Reich









During the late 1930s the German government invested heavily in turbojet and rocket technology – enabling the Luftwaffe to bring the world's first jet fighter, the Messerschmitt Me 262, into front line service in 1944.

Alongside it were two other cutting edge machines: the Me 163 rocket-powered interceptor and the Arado Ar 234 jet reconnaissance and bomber aircraft. But none of them could successfully do what Germany desperately needed them to do – destroy British and American bombers in large numbers.

Nor could they tackle roaming Allied fighter-bombers at low level or bring down the high-speed de Havilland Mosquito reconnaissance aircraft that overflew the Third Reich with impunity.

New aircraft were needed that could meet these needs and when aviation companies from across Germany set their finest minds to the task they produced some of the most radical designs the world had ever seen. They proposed rotating wing ramjet fighters, arrowhead-shaped rammers, rocket-firing batwinged gun platforms, sleek speed machines, flying wings, tiny mini fighters and a host of others ranging from deadly-looking advanced fighters to downright dangerous vertical launch interceptors.

Luftwaffe: Secret Jets of the Third Reich tells the stories of these and many other aircraft designed to defend Nazi Germany through rarely seen photos, new illustrations and original documentation from archives around the world.